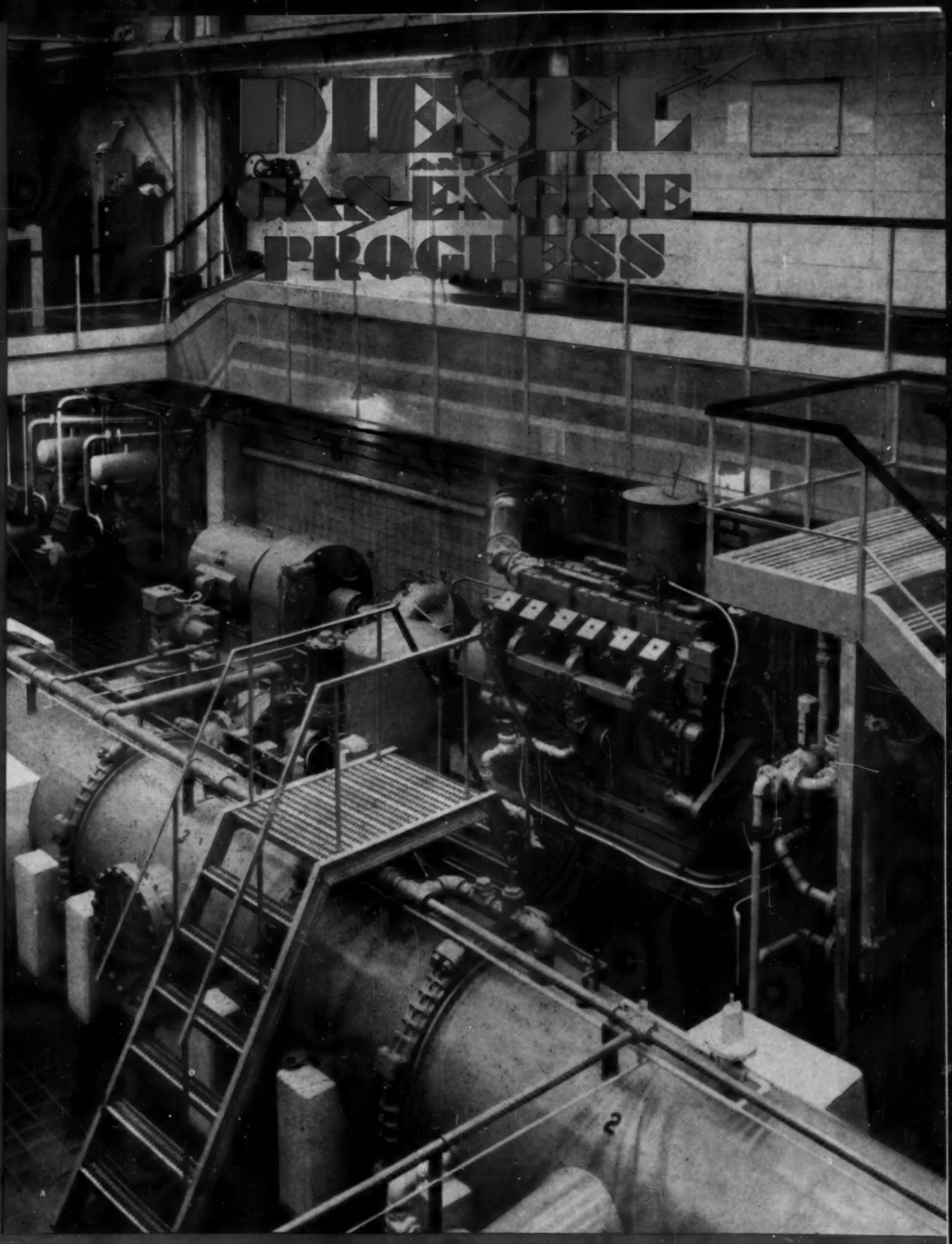
DIESEL and GAS ENGINE PROGRESS

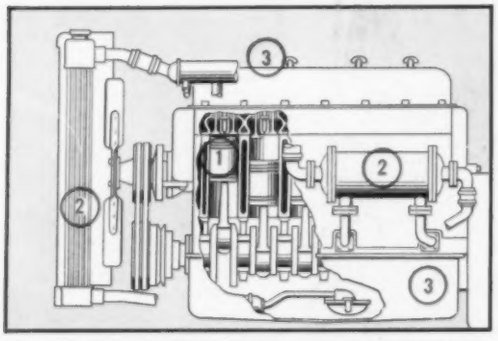
DIESEL ENGINES • DUAL FUEL ENGINES • NATURAL GAS ENGINES • GAS TURBINES



FIVE DOLLARS PER YEAR DECEMBER, 1961 FIFTY CENTS PER COPY

TEXACO DIESEL DATA

HOW TO REDUCE ENGINE DEPOSITS AND LUBE OIL CONTAMINATION



THREE MAIN CAUSES OF ENGINE DEPOSITS are 1) incomplete combustion, 2) inadequate cooling, 3) poor crankcase ventilation.

Keeping diesel lube oil clean is one of the most valuable types of preventive maintenance, but it's a very complex problem, with many aspects. This is a simplified rundown on three major types of deposits that may form in diesel engines, and some of the maintenance techniques that work best to prevent each type.

Engine deposits; three types, three causes

The usual diesel engine deposits may combine two or all three of these basic types:

1. Oil-carbon deposits, composed of oil mixed with the soot of incomplete fuel combustion.

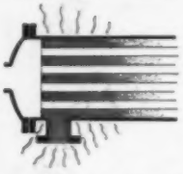
2. Oil-oxidation sludge, composed of oil mixed with oxidized matter resulting from the combining of some of the oil with oxygen at temperatures between 200-500°F.

3. Oil-water sludge, composed of used oil mixed with water and other substances, such as soot or dirt, which prevent easy separation of the oil from the water.

Minimize oil-carbon deposits by improving fuel combustion

To improve fuel combustion: check fuel injection to make sure each cylinder is getting the same amount of fuel; make sure the engine isn't overloaded; check air-intake system for restrictions; increase cooling system temperature; eliminate hard pulls at low rpm; or use lighter, higher-cetane fuel. Other methods for reducing oil-carbon sludge are: use detergent oil; renew piston rings and liners; improve oil purification; drain oil more frequently.

Minimize oil-oxidation deposits by reducing oil temperature



To reduce oil temperature: check cooling system, fan, water pump, radiator; check for deteriorated hose or loose connections; check for scale in water jackets; install lower temperature thermostat; clean the oil cooler, or consider replacing with a larger one. Other methods for reducing oil-oxidation sludge are: use heavy-duty oil; either flood hot spots or prevent oil from reaching them; drain oil more frequently; use higher-cetane, lower-sulfur fuel.

Minimize oil-water sludge with warmer or better-ventilated crankcase

To raise engine temperature: warm up engine more quickly, check thermostat in cooling system, use radiator shutters; raise jacket temperature, reduce oil cooling, insulate crankcase, remove fan during severe cold weather. Crankcase ventilation can be increased by placing ventilation outlet in air stream or in exhaust ejector, or by connecting to engine air intake system. Other methods of reducing oil-water sludge are: keep oil exceptionally clean by improving purification, permitting water to separate; improve steadiness of load by reducing amount of idling, light-load operation and number of starts; eliminate water leaks; install reclaimer or centrifuge in addition to filter to remove water from oil; drain oil more frequently.

Keep in touch with your lubricant supplier

You've probably noticed that the recommended cures for different types of sludge are sometimes contradictory. Since sludge in most engines may have two, or even three, different causes, your first move in solving a sludge problem should be to consult an experienced lubricant supplier. The proper application of these recommendations depends on a thorough analysis of the engine and its operating conditions, and the man who can do this job best is one who knows, from experience, which compromise will work best.

Texaco has many years' experience fueling and lubricating diesel engines of all sizes, in all types of operations. If you need help or information, call the nearest of the more than 2,300 Texaco Distributing Plants, or write Texaco Inc., 135 East 42nd Street, New York 17, New York.

Tune In: Huntley-Brinkley Report, Monday Through Friday—NBC-TV

TEXACO

Throughout the United States
Canada • Latin America • West Africa

WITH SEALED POWER ELECTRO-POLISHED STAINLESS STEEL OIL RINGS

diesels deliver the goods—lower hauling costs

CONSTRUCTION WORK isn't a "gravy job," even for husky diesels. King-size loads and no roads, high operating temperatures and unavoidable lugging take their toll on engines.

To stretch engine life, get more miles between overhauls, cut costs right to the bone—well, that's the stock in trade of Sealed Power KromeX ring sets with Stainless Steel oil rings.

Stainless Steel is a superior metal. It doesn't corrode, it resists pitting and etching of gases and acids so carbon doesn't cling. Return oil vents stay clean, remain open for better lubrication and less friction. And Stainless Steel retains tension at high temperatures!

Sealed Power's end-abutment design is patented, it is proven. It controls oil from the start. The Stainless Steel oil ring in KromeX ring sets is easy to install. It's a money maker because it's a cost cutter! Sealed Power Corporation, Muskegon, Michigan.

Sealed Power KromeX Ring Sets

deliver more power, better oil control

PISTONS • PINS • SLEEVES AND SLEEVE ASSEMBLIES • VALVES • WATER PUMPS • TAPPETS

DIESEL AND GAS ENGINE PROGRESS

REX W. WADMAN — *Editor and Publisher*

DIESEL ENGINES • DUAL FUEL ENGINES • NATURAL GAS ENGINES • GAS TURBINES

BRUCE W. WADMAN — *Executive Vice Pres.*
ROBERT E. SCHULZ — *Vice Pres., & Managing Editor*
ANTHONY A. ALBERTE — *Associate Editor*
JAMES W. BROWN — *Midwest Editor*
ELTON STERRETT — *Southwest Editor*
JANE A. JURICK — *Circulation Manager*

CONTENTS FOR DECEMBER, 1961

MEMBER OF BPA

Business Publications Audit of Circulation, Inc.

DIESEL AND GAS ENGINE PROGRESS for December, 1961, Vol. XXVII, No. 12. Published Monthly by Diesel Engines, Inc., 1701 W. Wisconsin Ave., Milwaukee 3, Wisc. Phone DIvision 4-5355. Subscription rates are $5.00 for U.S.A. and possessions. All other countries $7.50 per year. Subscriptions may be paid the London Office at £2-12s-6d per year.

DIESEL AND GAS ENGINE PROGRESS is indexed regularly by Engineering Index, Inc. and is available in microfilm editions from University Microfilms, Inc., Ann Arbor, Michigan.

MEMBER OF MPA

Magazine Publishers Association, Inc.

EXECUTIVE OFFICES
10850 Riverside Dr.
North Hollywood, Calif.
TRiangle 7-5331

EDITORIAL OFFICES
1701 W. Wisconsin Ave.
Milwaukee 3, Wisc.
DIvision 4-5355

BUSINESS OFFICES

MILWAUKEE 3:
Bruce W. Wadman
1701 W. Wisconsin Ave.
DIvision 4-5355

LONDON E.C. 4:
G. L. Fetherstonhaugh
St. Paul's Corner
Ludgate Hill
City 5318

FIELD EDITORS

HIALEAH, FLA.:
Edwin Dennis
250 W. 50th St.
TUxedo 8-2188

WALNUT CREEK, CALIF.:
F. Hal Higgins
90 Grand View Place
YEllowstone 4-9531

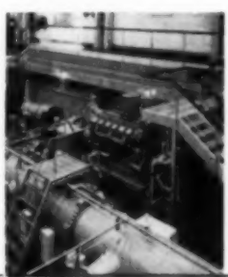
HOUSTON 18, TEXAS:
Donald M. Taylor
1345 Chamboard Lane
OVerland 6-1127

HOUSTON 6, TEXAS
Elton Sterrett
1948 Lexington
JAckson 2-9088

JEFFERSON CITY, MO.:
L. H. Houck
400 Linden Dr.
Phone: 6-2993

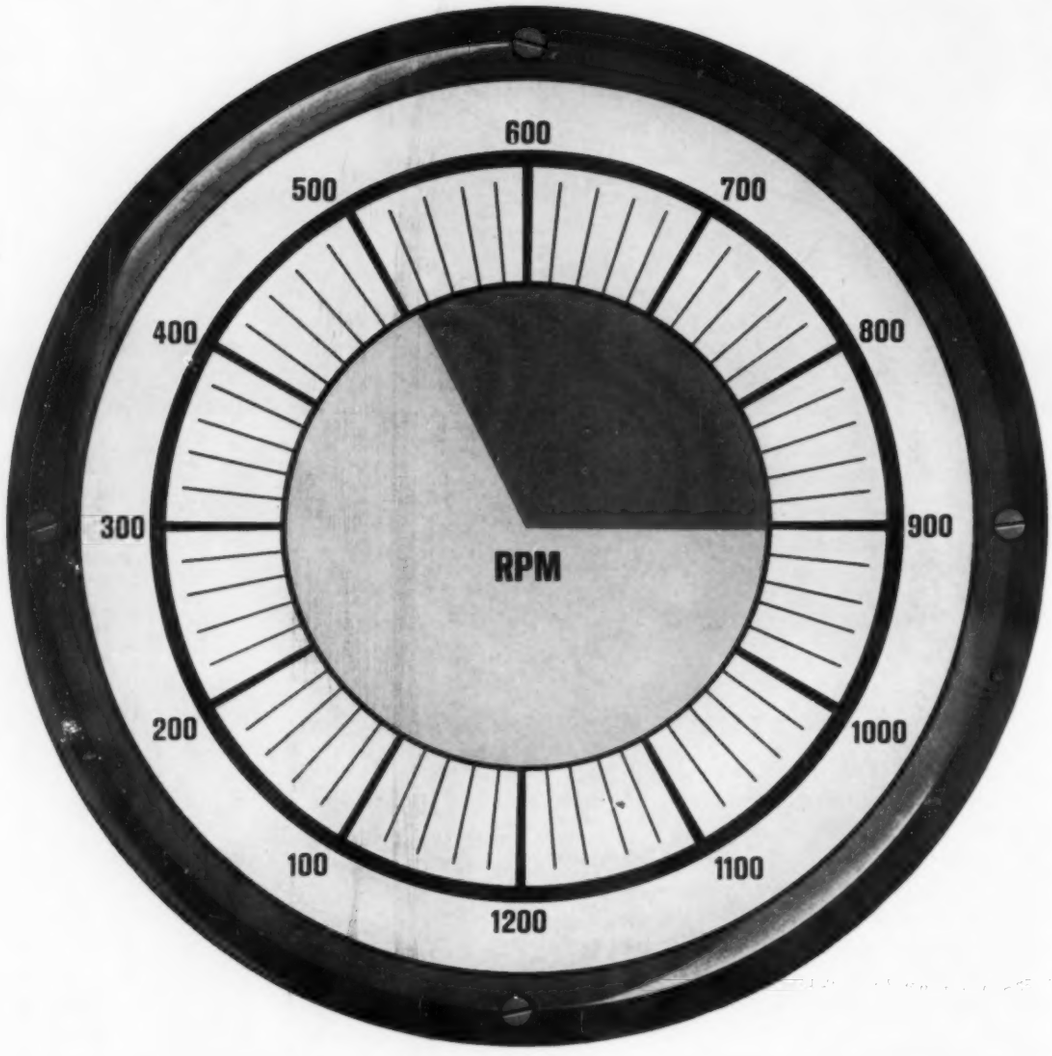
LOS ANGELES 46:
James Joseph
8421 Melrose Ave.
OLive 3-4542

DETROIT 39, MICH.:
James W. Brown
15936 Kinloch Road
KEnwood 2-1545



FRONT COVER ILLUSTRATION

Cleaver V-125 natural gas engines provide standby power for pump drives at station of the Winnipeg, Manitoba water works. For story on this Canadian installation, see page 22.

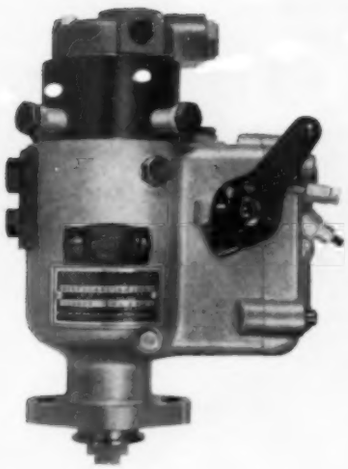


EACH ADDED RPM CAN SAVE YOU $775

Seven ALCO 251 diesel electric sets for an Advanced Research Projects Agency installation in the Pacific will each generate 1500 kw at 900 rpm. Their medium speed will save about $300,000 per unit over low-speed engines. Factors in this lower cost: suitability to mass production and pre-packaging, lower transportation and erection costs, less complexity in electrical equipment. Can you use savings like these in your stationary diesel operations? ALCO Products, Inc., Dept. 1216, Schenectady, N.Y.

Product quality comes first

ALCO DIESEL ENGINES



PROGRESS THROUGH SIMPLICITY

Roosa Master's revolutionary design has made a most significant contribution to the diesel industry. Roosa Master has helped increase engine speed. Roosa Master accessories have helped solve engine manufacture problems. Simplicity of design saved space, lowered costs, and led to progress in diesel engine manufacture. Let us show you how Roosa Master can contribute to your new engine design. Hartford Machine Screw Company, Division of Standard Screw Company, Hartford 2, Connecticut.

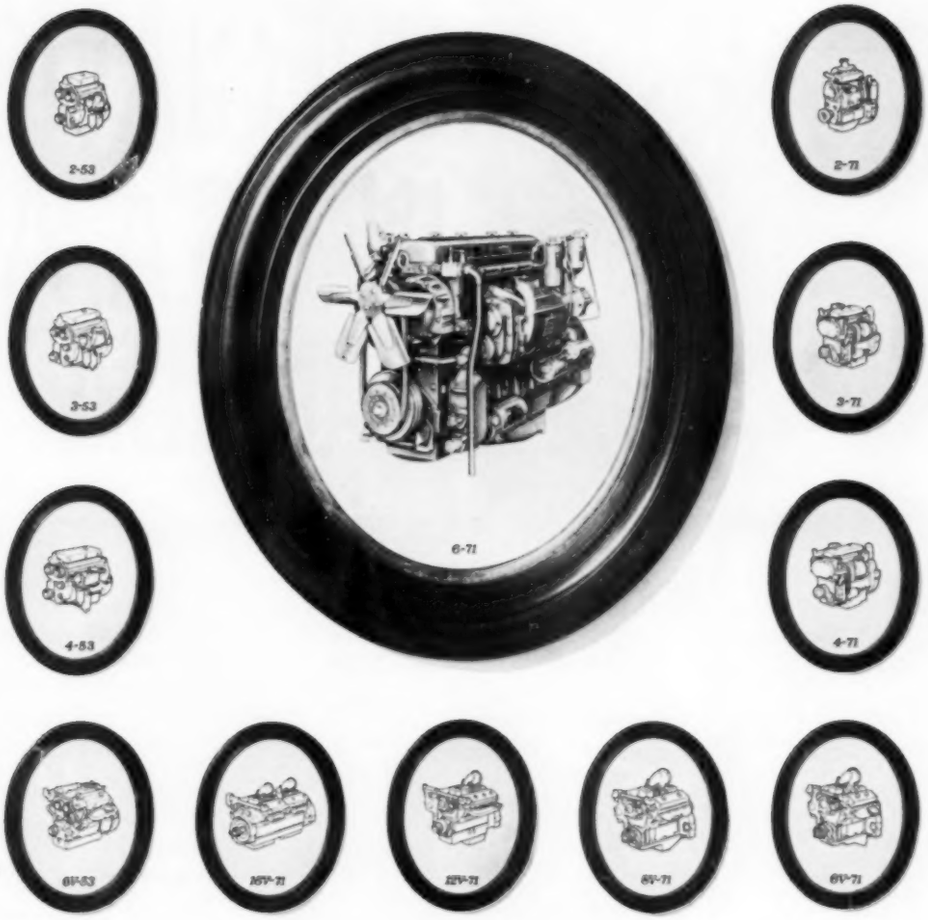
you can depend on the diesel that depends on HMS ROOSA MASTER

■ Present-day river towboat operations demand nothing less than the best in reliability, efficiency and economy. ■ Among the "partners" making this possible on Union Barge Line's new craft are: Dravo Corp.—builder of the two towboats; Nordberg Mfg. Co.—builder of the diesel engines; and Scintilla Division, The Bendix Corporation—developer of the 24 injection pumps that feed fuel to the giant 3200-horsepower diesels. ■ Bendix® Fuel Injection is serving a variety of diesel engine needs efficiently—not only in the marine field, but in locomotive and stationary engines as well. Proof: more diesel engine manufacturers are specifying Bendix than ever before in history. ■ Get full details on Bendix Fuel Injection by writing The Bendix Corporation, Scintilla Division, Sidney, N. Y. Export Sales & Service: Bendix International, 205 E. 42nd St., New York 17, New York.

POWERFUL NEW TOWBOAT "TWINS" RELY ON BENDIX FOR FUEL INJECTION

Modern Mississippi River towboats operated by Union Barge Line, the Navigator and the Mariner are each powered by two Nordberg diesels and are each capable of pushing 30 or more loaded barges.

Scintilla Division THE Bendix CORPORATION



All in the family

A full power Diesel line—20 to 1008 h.p.—built to just *one basic design.*

That's the unique GM Diesel *family of engines concept*—the big difference in Diesel-powered equipment today.

Here's how it can make a big difference in your power and profit picture.

One design gives you lowest-cost parts and service, with *unmatched interchangeability of identical parts.*

One design (job-proven by over 90 million horsepower) lets the latest power advances be added without sacrificing reliability and long life—gives you greater value in *every* engine.

One design lets you meet growing horsepower needs merely by moving to the next engine in the series.

Result: The *more* GM Diesels you use, the *more* you profit *per engine.*

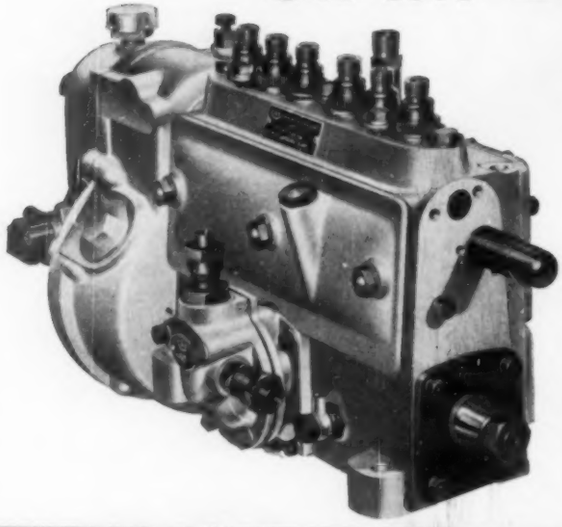
That's why, whether you buy new equipment from a manufacturer or repower the equipment you now have, it will pay you to *specify* GM Diesel. Detroit Diesel Engine Division, General Motors, Detroit 28, Michigan. (In Canada: General Motors Diesel Limited, London, Ontario.)

GM DIESEL

SERIES 53 & 71 ENGINES

One proven design throughout the line builds greater value into every engine

C.A.V. DIESEL SERVICE SPECIALISTS IN U.S.A. AND CANADA



U.S.A.

ALABAMA
Birmingham
Mobile

ARIZONA
Phoenix

ARKANSAS
De Witt
North Little Rock

CALIFORNIA
Bakersfield
El Centro
El Monte
Fresno
Long Beach
Los Angeles
San Diego
San Francisco
Wilmington

COLORADO
Denver

DELAWARE
Milton

FLORIDA
Jacksonville
Orlando
Miami
Tampa

GEORGIA
Atlanta

IDAHO
Pocatello
Twin Falls

ILLINOIS
Chicago

INDIANA
Indianapolis

IOWA
Des Moines

KANSAS
Colby
Garden City
Great Bend
Grinnell
Hutchinson
Plainville
Salina
Wichita

KENTUCKY
Louisville

LOUISIANA
Baton Rouge
Lake Charles
Morgan City
New Iberia
New Orleans
Shreveport

MARYLAND
Baltimore

MASSACHUSETTS
Boston
Springfield

MICHIGAN
Detroit
Grand Rapids
Ishpeming
Lansing

MINNESOTA
Hibbing
Minneapolis

MISSISSIPPI
Jackson
Meridian

MISSOURI
Kansas City
St. Louis

NEBRASKA
Gordon
Lincoln
McCook
North Platte
Omaha

NEW MEXICO
Albuquerque

NEW YORK
Buffalo
Broooklyn
Long Island
New York

NORTH CAROLINA
Charlotte
Raleigh

NORTH DAKOTA
Fargo
Minot

OHIO
Akron
Cincinnati
Cleveland
Dover
Toledo

OKLAHOMA
Enid
Oklahoma City
Ponca City

OREGON
Portland

PENNSYLVANIA
Philadelphia
Pittsburgh

SOUTH DAKOTA
Winner

TENNESSEE
Chattanooga
Knoxville
Memphis
Nashville

TEXAS
Amarillo
Beaumont
Corpus Christi
Dallas
Houston
Odessa
San Antonio

UTAH
Salt Lake City

VIRGINIA
Norfolk
Richmond
Salem

WASHINGTON
Seattle
Spokane

WISCONSIN
Milwaukee
Sun Prairie

CANADA

ALBERTA
Calgary
Edmonton
Lethbridge
Medicine Hat

BRITISH COLUMBIA
Vancouver

MANITOBA
Winnipeg

NEW BRUNSWICK
Fredericton

NOVA SCOTIA
Halifax
Liverpool

ONTARIO
Brockville
Cornwall
London
Ottawa
Pembroke
Sudbury
Toronto
Thornhill

QUEBEC
Montreal
Quebec

SASKATCHEWAN
Regina
Saskatoon

The World's Largest Manufacturers of

FUEL INJECTION EQUIPMENT

C.A.V.

For full list of Service Agents write to:
Fuel Injection Equipment Division of
LUCAS ELECTRICAL SERVICES, INC.
Head Office: 501 West 42nd Street, New York 36, N.Y.
Sales Office: 14820 Detroit Avenue, Cleveland 7, Ohio
Factory Branches: Los Angeles, San Francisco, Seattle, Denver, Chicago, Houston, Jacksonville, Boston, Baltimore

JOSEPH LUCAS (CANADA) LTD.
Head Office: Toronto
Factory Branch: Montreal

AP 130

TEAR OUT FOR YOUR FILE

TEAR OUT FOR YOUR FILE

SPICER "SPECS"

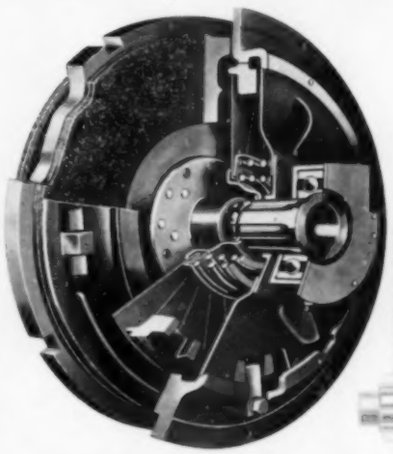
SPICER MULTIPLE-LEVER CLUTCHES Provide Longer Life, Less Down Time, Reduced Maintenance!

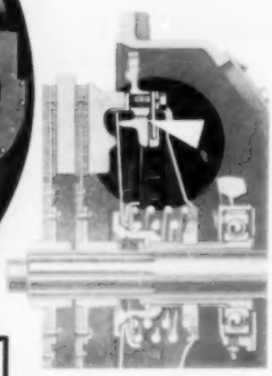
ENGINEERED TO HANDLE TOUGH ASSIGNMENTS

You save money with Spicer clutches. They outlast ordinary clutches because their full circle of levers and centrally located springs provide uniform overall loading on the pressure plate, therefore are not damaged by heat. This, plus a well ventilated cover, makes the Spicer clutch cooler operating—thereby giving longer life.

The multiple levers are resilient and provide a cushioning effect. "Passenger car smoothness" of engagement reduces wear on transmission and drive line components, with the durability of rigid discs for longer life.

Full Torque Capacity of Spicer multiple-lever clutches is maintained by the internal adjusting ring, easily accessible through the bell housing inspection plates. This type of adjustment compensates for wear in a way that mere adjustment of external linkage cannot. "Like new" performance is obtained because the original spring pressure is restored. No special tools are required, and there is no chance of affecting the internal parallelism.





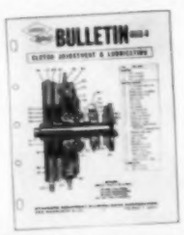
Arrow in cutaway illustration points to the exclusive Spicer Internal Adjusting Ring.

SPICER MULTIPLE-LEVER CLUTCH AVAILABILITIES

SIZE	NO. OF PLATES	WEIGHT (lbs.)	NOMINAL TORQUE CAP. (lbs. ft.)
13"	Single	45	265
13"	Two	84	500
14"	Single	58	375
14"	Two	96	625
15½"	Single	110	500
15½"	Two	140	1000

Easier Shifting to 1st and Reverse—The Spicer multiple-lever clutch with exclusive pull type release makes possible the use of an effective clutch brake to stop rotation of the transmission gears. This permits shifting to first or reverse without gear clash.

For complete information on clutch adjustment and lubrication, plus helpful hints on reduction of maintenance through proper driving habits, write for a free copy of Bulletin C111-4. Address Dana Corporation, Toledo 1, Ohio.



SPECIFY SPICER!

DANA Spicer

DANA CORPORATION

Toledo 1, Ohio

Spicer products available in Canada through Hayes Steel Products Ltd., Merritton, Ontario

Reprints of this ad are available on request

AiResearch turbocharging...

DIESEL EARTHMOVERS

SMALL AIRCRAFT GASOLINE ENGINES

NATURAL GAS COMPRESSORS

matches any reciprocating engine application from 50 to 2000 hp

AiResearch gives you the best and most economical turbocharger match for many different engine applications and sizes. Basic design characteristics permit the turbocharger size to be scaled up or down in a variety of ways without loss of efficiency or suitability for mass production.

The number of applications for any one frame size of turbocharger is also increased by the use of simple, off-the-shelf, interchangeable components to meet the changing engine horsepower, rpm and torque rise characteristics.

AiResearch Industrial Division is turbocharging diesel, natural gas and gasoline engines from 50 to 2000 hp in a wide variety of applications: earthmoving, marine and other vehicular uses, stationary and portable electrical power generation and pumping, small aircraft, automotive, gas compressing and many others.

GARRETT

AIRESEARCH INDUSTRIAL DIVISION • *9225 South Aviation Blvd., Los Angeles 45, California*

Designers and manufacturers of turbochargers and specialized industrial products

West Coast News

By James Joseph

TO Kaiser-Raymond-Macco-Puget Sound, joint contractors for the Lower Monumental Dam project in Oregon, an Allis-Chalmers 21000 package unit with Twin Disc clutch. Sale by Hamilton Engine Sales, Inc. Portland.

PURCHASED: for the Mohole Project's ocean-floor drilling barge, Cuss II, eight Cummins VT-12's, turbocharged, 600 hp at 2100 rpm diesel engines, by Los Angeles' Global Marine Exploration Co.

FOR San Leandro (Calif.) Memorial Hospital, a Caterpillar D343, SRSE standby electric set, delivering 175 kw. Sale by Peterson Tractor Co., San Leandro.

TO Harbor Tug & Barge Co., San Francisco, two Caterpillar D379 diesel marine engines with Caterpillar 3181 reverse and reduction gear. Each engine is rated 510 hp. continuous.

CORPS of Engineers, Portland, Ore., has taken delivery of an air-cooled 36 hp diesel, to operate pumps, the sale by Hamilton Engine Sales, Inc. Portland.

TO repower a trolling boat (43 ft.) operating from Newport, Ore., an Allis-Chalmers 11000 marine diesel (200 hp at 200 rpm), with Capitol 3.5:1 gear.

GILBERT Logging Co., Sweet Home, Ore., has repowered a BU-135 Skagit with an Allis-Chalmers 21000 converter package, for logging in Callipooya area.

SOLD: two 150 kw Caterpillar diesel-electric sets for the new tuna seiner Royal Pacific, operating Seattle waters. Sale by N C Machinery Co., Seattle.

TO repower his 54-B Bucyrus shovel, Tacoma's Lige Dickson has purchased an Allis-Chalmers 21000 power package with 16:1 Clark converter.

J. S. Barrett, Santa Ana, Calif. contractor, has purchased a Murphy MP-24T, rated 300 hp at 1200 rpm to repower a model 1054 P&H crane, for work on San Diego County's sewage treatment outfall project. Sale by Industrial Engine Service, Los Angeles.

DELIVERED: a 16000 Allis-Chalmers diesel and torque converter package to C. J. Montag & Sons, Inc., for Springfield (Ore..) sewer job.

REPLACING two 75 kw electric sets on a gravel plant is a 21000 Allis-Chalmers 200 kw intermittent diesel electric set, sold to Guy Norris, Kelso, Washington.

SOLD: two Caterpillar D311, SRSE electric sets, each rated 30 kw. to Harbor Tug & Barge Co., operating the San Francisco Bay area.

INSTALLED: in Pierpoint Sportfishing Landing's two new boats, the *Freedom* and *Liberty*, each an Osco Ford 4-cylinder diesel driving a Palmer 20 kw generator (1800 rpm), the output 208-volts ac, to power refrigeration, bait pumps, electrical accessories. Sold and installed by Fellows and Stewart, Wilmington, Calif.

WORK has begun on the $7.55 million "world's longest" aerial tramway, by the Mount San Jacinto Winter Park Authority, the tram to climb from Palm Springs, Calif., to Mt. San Jacinto. Diesel standbys (as yet unspecified) will back 900 hp electric motor powering this, U. S.'s biggest aerial tram, scheduled for completion in mid 1963.

INSTALLED: in Randolph Elliott's Mack model END-673T, a new Cummins "compact" V8-265 (265 hp at 2600 rpm), by Cummins Service and Sales, Los Angeles.

Mid-West Diesel News

By **L. H. Houck**

LIST & Clark Construction Co., Kansas City, Cummins NHRF-6-BI, 330 hp for spare for Euclid, for Oklahoma job.

CUMMINS C-305 to Roy Baker Quarry, Pleasanton, Kan., for installation in a Unit shovel. Sale by Cummins, Kansas City.

TWO Caterpillar D-353 diesels to Co-Op Farm Chemical Co., Lawrence, Kan., for driving Westinghouse dc generators on a locomotive. Sale by Martin Tractor Co., Inc., Topeka.

CATERPILLAR 1673 diesel to Crouch Bros., St. Joseph, common carriers, for installation in an IHC DCO-405 tractor.

J. A. Riggs Tractor Co., Little Rock, now has Cat's new 220 hp truck diesel and several repower installations have been made.

CONSUMERS Co-Op, Kansas City, NH-220 Cummins for installation in a DC-405 IHC truck, from Cummins, Kansas City.

RINGSBY Truck Lines, Denver, 12 Brown reefer trailers with Mercedes-Benz diesel refrigerator units.

WILSEY, Bennett Co., Oklahoma City, 12 K-523 Kenworths with Cummins NH-250 diesels, Fuller 10 speed transmissions, Timken SQHD rear axles, for hauling butter to West Coast and return loads of flowers.

KOHLER 45 kw generating set to Community Medical Center, Gardner, Kan., from AAA Engine & Electric, Inc., Kansas City, Kan. Engine is Hercules GO-339 gas.

CUMMINS, Joplin, Mo., sold Roy Barsh Truck Lines a Cummins C-180 for installation in a White.

BYERS Transportation Co., Kansas City, five C-180 Cummins diesels to go in White 9000 tractors. Sale by Cummins, Kansas City.

TO Dawson Springer Co., Manitowoc, 38 White tandem cement haulers, Cummins NH-220 diesels, Fuller 10 speed RoadRanger transmissions.

TO Ash Grove Lime & Cement Co., Chanute, Kan., Michigan loader with Cummins diesel.

ASH Grove Cement Co., Springfield, Mo., bough five LeTourneau-Westinghouse haulers with NH-180 Cummins diesels.

LEHIGH Portland Cement Co., Iola, Kan., NH-195 Cummins diesels in 16 White tractors for hauling bulk cement trailers.

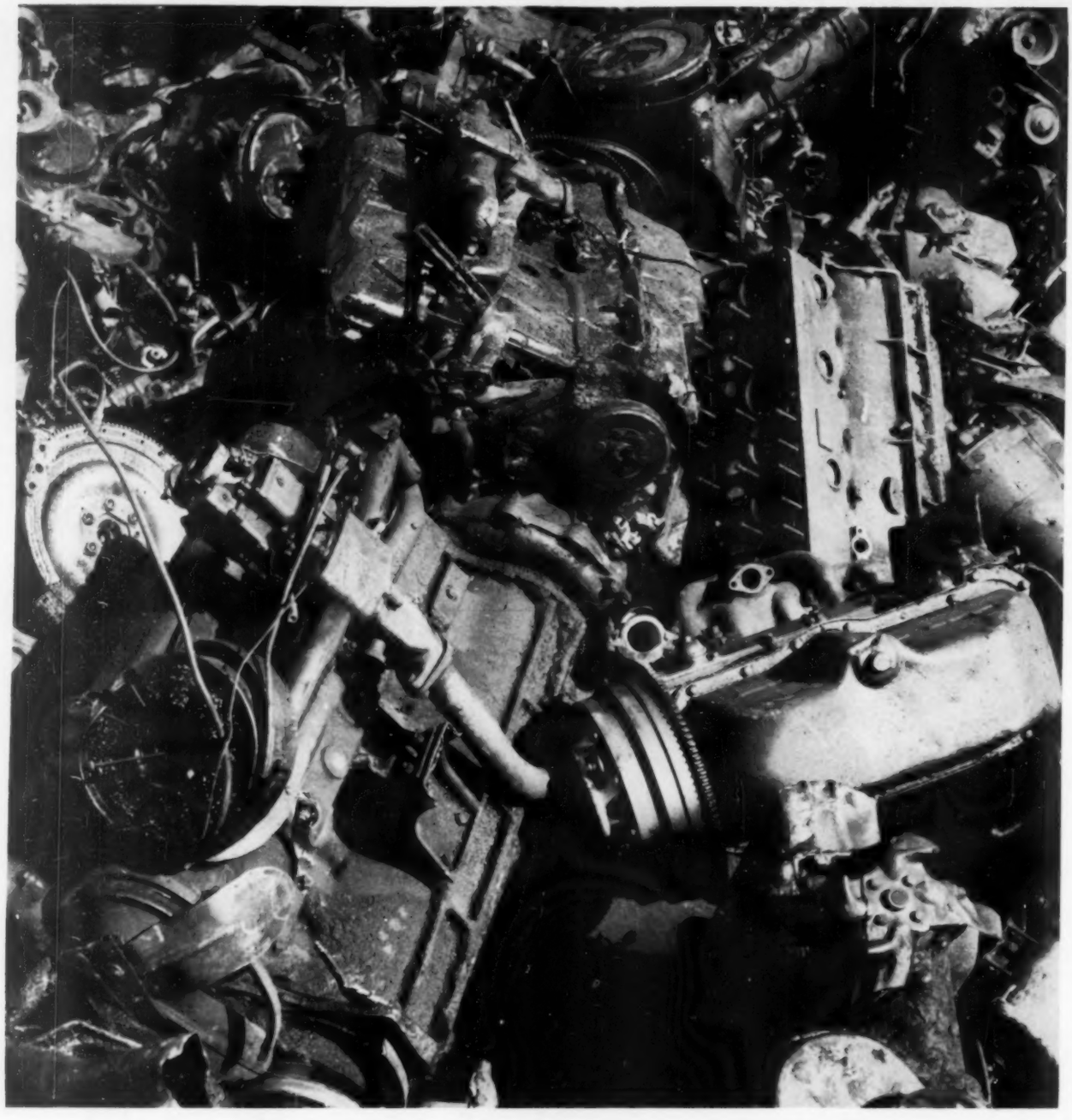
GRAYSTONE Quarries, Springfield, Mo., a Hough loader with a C-175 Cummins.

MISSOURI Pacific RR, Kansas City, a Cummins HRF for installation in a Plymouth locomotive.

COOK Construction Co., a Michigan loader with Cummins diesel for job near Burlington, Kan.

American Bosch Secretary

The board of directors of American Bosch Arma Corp. has elected David F. Devine secretary of the corporation. Mr. Devine has been a vice president of American Bosch Arma since its incorporation in 1954 and treasurer of the corporation since 1958. He will continue in these positions in addition to his new post. He was a vice president of Arma Corporation for two years prior to its reorganization in 1954 as a division of American Bosch Arma Corp.



How to keep them out of the graveyard longer

Why do some engines die before their time? The answer could be in the lubricating oil you are using. Hundreds of documented case histories show that fleet owners have added up to 50% to the life of their engines . . . using RPM DELO Oil. Special compounding cleans and protects vital engine parts . . . reduces over all maintenance costs. In fact, many fleet owners say "RPM DELO" *is* preventive maintenance. Try it. Your equipment will be rolling for a long time to come.

STANDARD OIL COMPANY OF CALIFORNIA
San Francisco 20
STANDARD OIL COMPANY OF TEXAS
El Paso
CALIFORNIA OIL COMPANY
Perth Amboy, N.J.—Denver

TRADEMARKS "RPM DELO" AND CHEVRON DESIGN ®

NAVIGATOR AND *MARINER*– NEW PARTNERS IN RIVER POWER

Union Barge Line Puts Two Dravo-Built 6400 HP Towboats in Service, Each Powered by Twin Nordberg Turbocharged Diesels

TWO new 192 ft. twin screw towboats, each rated 6400 hp and powered by a pair of Nordberg turbocharged V-type diesels, have gone into the service of Union Barge Line Corp. Built by Dravo Corp. and christened in Pittsburgh recently, the *M/V Navigator* and *M/V Mariner* will be used primarily on the open water of the Mississippi River between St. Louis and New Orleans. As of mid-October, the new "partners" have been used only in the general Pittsburgh area pending the time required to integrate them into Union Barge's common carrier service on the Lower River. According to A. J. Brosius, assistant to the president of Union Barge, the vessels will have no regular assigned barges or tow. Power is adequate to push tows of 30 or more loaded barges, the exact number, of course, depending on river conditions and size of barges.

The *Navigator* and the *Mariner* are the fifth and sixth new towboats to be added to the UBL fleet in the past eight years and gives the company a total of 11 such vessels and more than 300 barges of all types for use in common carrier and contract service. Last to be officially christened was the *Navigator* and the traditional bottle was wielded on September 25 at Pittsburgh's Allegheny River Wharf by Mrs. David Lawrence, wife of the Governor of Pennsylvania. Since the new boats are sisters and identical in all respects, this article will concern itself primarily with a complete description of the *Navigator*.

Designed and built by Dravo at its Neville Island yard, the *Navigator* is of all welded steel construction, 192 ft. long, 52 ft. wide, and 12 ft. deep from main deck to hull bottom. Her tall three-story pilothouse provides required visibility over a long tow and from an appearance standpoint, a distinguishing feature is the unusual width of the guards around the main deckhouse. But the *Navigator* has other differences which are not so readily visible—one in particular is that complete control of the vessel, with the exception of engine starting, is provided in the pilothouse.

For propulsion power, Dravo selected the 12 cylin-

The *M/V Navigator* above, and the *M/V Mariner* to the right are the two highest horsepower towboats to enter service in 1961. Each rated 6400 hp on twin screws, the vessels are owned and operated by Union Barge Line.

der four-cycle Nordberg Supairthermal non-reversing diesel rated 3200 continuous hp at 174 bmep, 514 engine rpm and 190 propeller rpm. These V-type engines, installed in pairs, have a 13½ in. bore and 16½ in. stroke and incorporate high pressure turbocharging (twin 2.7:1 pressure ratio Elliott turbos); cooling of the inlet air after turbocharging through Young intercoolers; and variable inlet valve timing control. Each engine drives through a Western SeaMaster model 320 PCMR-AH reverse-reduction gear that externally mounts dual Wichita air actuated clutches which control ahead or astern rotation. Drive is to two five-bladed propellers, each 10 ft. in diameter and made of high tensile stainless steel. Propeller pitch, area and blade form have been designed by Dravo for Kort nozzle application. Each propeller shaft is supported by a single-armed stainless steel strut faired to a steering rudder and extending into the hull structure from where it carries down into the Kort nozzle bottom.

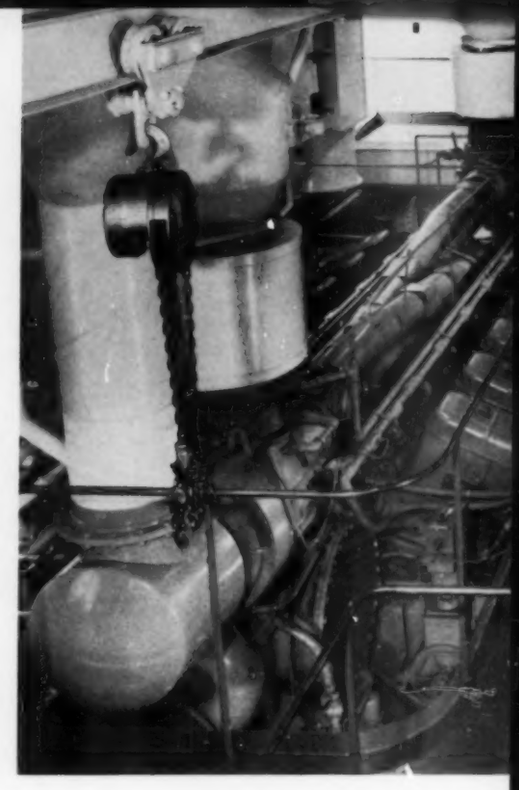
Full control of the vessel at all times, except engine starting, is in the hands of the pilot and to meet these requirements, the pilothouse is exceptionally well instrumented as is illustrated. Single lever Westinghouse Air Brake controls are installed for each Nordberg diesel not only because of their simplicity, but also since they permitted the engine builder to incorporate a fuel limiting device to minimize "black smoking" caused by excess fuel in cylinder during periods of heavy engine acceleration. With this system, a cam sends an air signal to the Woodward pneumatic governor to establish the desired engine speed. At the same time, a fuel rack limiting device on the governor limits the maximum fuel quantity consistent with engine rpm. Thus heavy firing at the low speeds is prevented and as speed builds up, the load limit is raised automatically.

New Monitoring System

Also built into the engine control and installed marine-wise for the first time, is a new system for automatic and continuous monitoring of engine exhaust temperatures. This system, completely described in D&GEP, June 1961 issue, is designed to eliminate the need for periodic, manual checking for high or low temperatures on each engine cylinder. The system incorporates a load-balancing Pyrotroller that automatically and continuously scans each cylinder, and relates each cylinder temperature, to the computed average of all the other cylinders. If the cylinder exhaust temperature should exceed a pre-determined range of variation, an audible alarm and light system would be actuated as part of vessel's automatic control system. This system, called Nordtronic and designed by Nordberg, monitors all normal engine conditions. Some malfunctions indicate only in the engine room, while other vital functions, such as the above mentioned high exhaust temperature, or low lube oil pressure, etc., will activate an audible buzzer and red light installed in the pilothouse, one set per engine. When an emergency occurs that would normally require shutdown of an engine, the alarm so advises the pilot. At that time he must take into consideration the position of his tow and decide whether to shut down the engine.

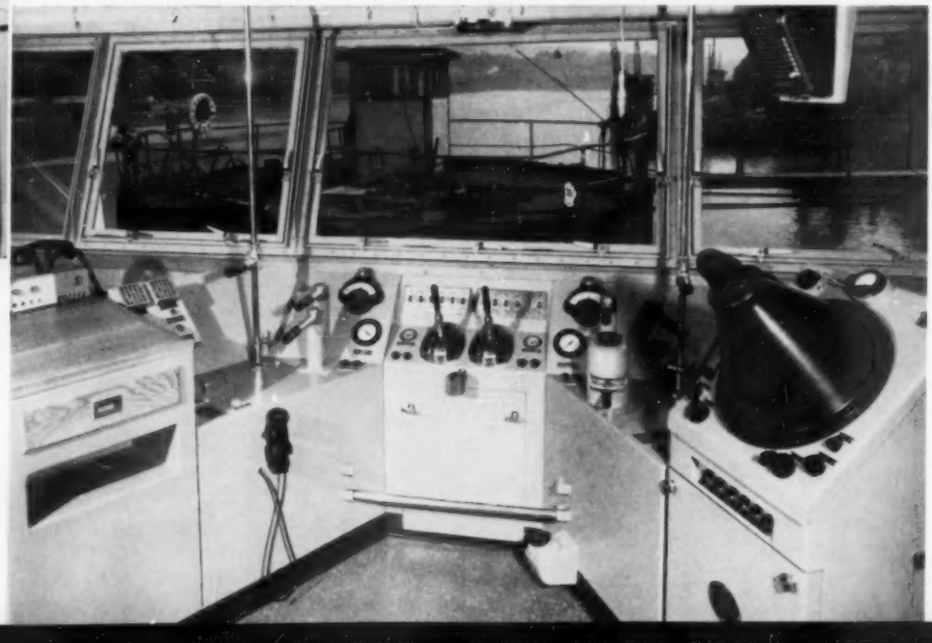
The engine room is very spacious and is forward of amidships with diesel fuel oil stored in wing tanks aft and outboard of the machinery space. The bulkhead at the aft end of the engine room is fitted with a watertight door for access from the machinery space to the shaft alley compartment which has an escape truck. Main propulsion machinery together with filters, centrifuges, etc., are, of course, located at lower engine room level while on the upper platform is installed the Lake Shore switchboard and two Caterpillar 150 kw, 440 volt diesel generator sets for ships' service.

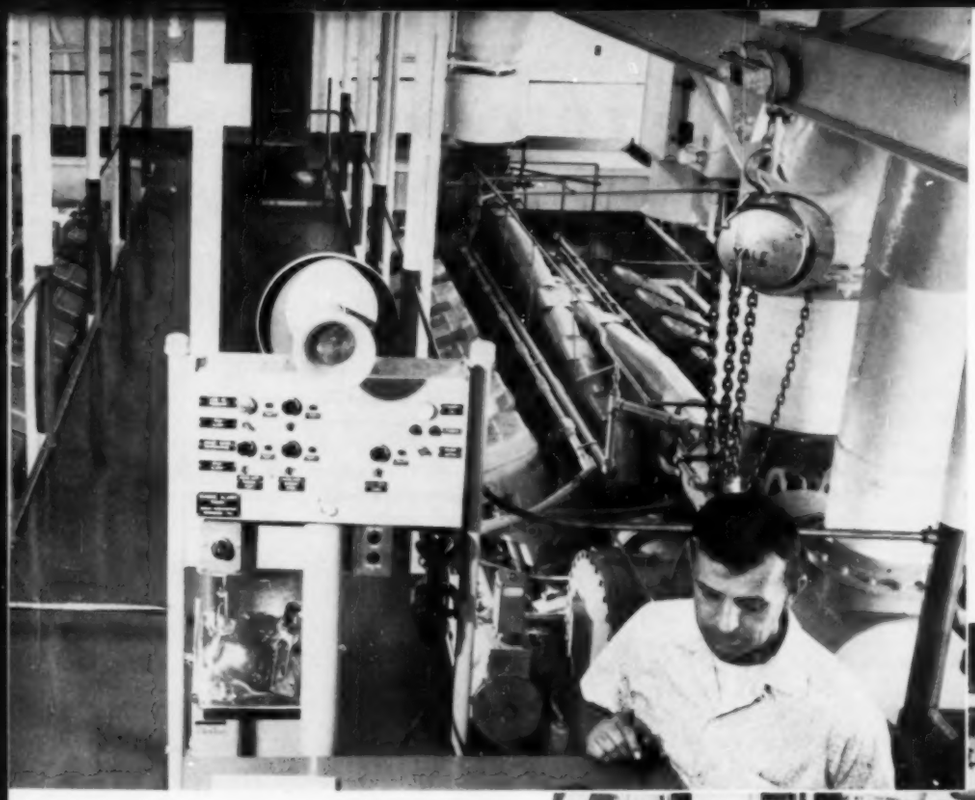
Pumps include two motor-driven lubricating oil pumps for priming and low engine rpm operation; two variable-volume hydraulic steering gear pumps, each driven by the diesel auxiliary unit and each rated at a working pressure of 575 psi; two self-priming 50 gpm centrifugal pumps for fuel oil transfer; a self-priming, fresh wash water pressure pump; an 80 gpm filter feed pump; a 200 gpm general service pump to supply water for the bilge system; a heating boiler and condensate pump; two strut bearing lubrication pumps; and a 200 gpm fire pump.



Nordtronic engine room control stand monitors all engine functions. Shown is Alnor exhaust scanning and monitoring Pyrotroller together with similar make pyrometers for measuring preturbine temperatures for dual Elliott turbochargers installed on each propulsion diesel.

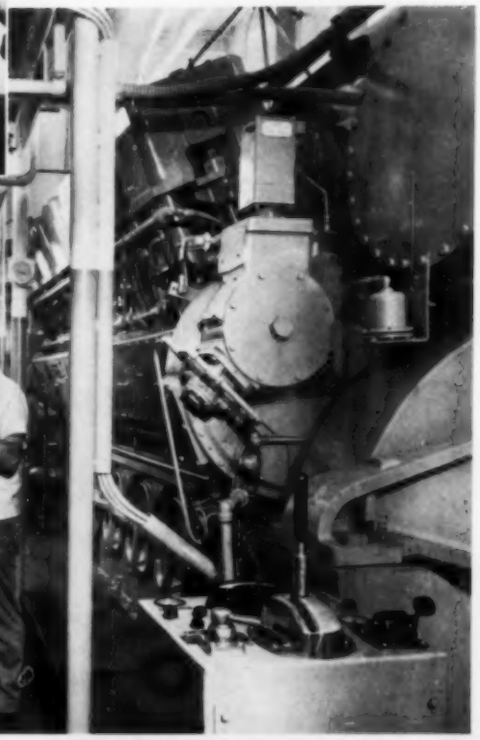
Well instrumented pilothouse of the *Navigator*. Note Westinghouse Air Brake single lever controls, Weston tachometers, and the alarm lights which signal engine room emergency. Pilot has complete control of vessel, except for engine starting.

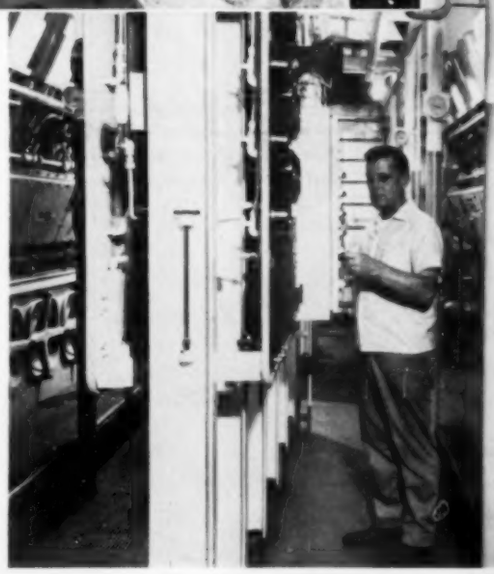




Upper platform on the *Navigator* shows both Nordberg Supairthermal propulsion diesels each rated 3200 hp at 514 rpm. Dual Elliott turbochargers are used in conjunction with intercooling. Engines exhaust through Kittell silencers.

Lower engine room level with operator at Nordtronic control board. In foreground is engine room control stand. Also shown is one of Woodward pneumatic governors and Young intake air intercooler.





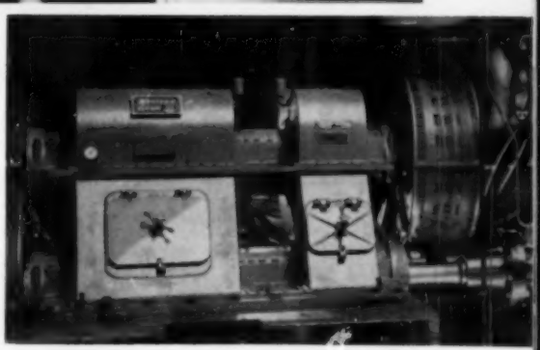
The superstructure includes the main deckhouse, upper deckhouse and pilothouse. Main deckhouse aft consists of five staterooms with single berths for the crew, a lounge, one stateroom with single berths for the cook and maid, a galley, messroom, a dry stores room and other facilities.

Continuous Rudder Indication

Steering and flanking are controlled from the pilothouse by two gears that operate independently from the same hydraulic pump. Steering and flanking levers transmit direction and degree through pneumatic controls. Each gear contains two hydraulic cylinders, a four-way steering valve, and a follow-up mechanism. An accumulator is furnished to maintain operating pressure. A Sperry Lever Pilot system complete with gyro compass has been installed for control of the steering valve. The follow-up system keeps the rudders at the same relative angle as the levers in the pilothouse; thus, the pilot has a continuous indication of rudder positions. The vessel's course is controlled by six streamlined, balanced rudders. One is located aft of each propeller for steering ahead and two forward of each wheel for flanking.

Principal Equipment *M/V Navigator* & *M/V Mariner*

Main engines	Nordberg
Main engine turbochargers	Elliott
Air clutches	Wichita
Reverse reduction gears	Western Gear
Propellers	Avondale
Jacket water pumps	Ingersoll-Rand
Main engine intercoolers	Young
Main engine mufflers	Kittell
Turbo lube oil pumps	Haight
Lube oil by-pass filter pump	Roper
Lube oil stand-by pump	DeLaval Steam Turbine
Lube oil (dirty oil) pump	Roper
Lube oil centrifuge	DeLaval Separator
Lube oil full flow filters	Commercial Filter
Lube oil by-pass filters	Commercial Filter
Strut bearing lube oil pump	Roper
Lube oil coolers	Young
Fuel oil booster pumps	Haight
Fuel oil centrifuge	DeLaval Separator
Fuel oil filters	Nugent
Turbo oil coolers	Perfex
Governors	Woodward
Injection pumps	Scintilla
Main engine intake air filters	American
Air compressors	Ingersoll-Rand
Diesel generators	Caterpillar
Aux. diesel mufflers	Maxim
Switchboard	Lake Shore Electric
Monitoring system	Alnor
Pneumatic engine controls	Westinghouse Air Brake



Each Nordberg diesel drives through a Western PCMR SeaMaster reverse-reduction gear equipped with dual Wichita air actuated clutches. Gear ratio is 2.77:1 for propeller speed of 190 rpm.

EMD'S NEW 2,250 HP LOCOMOTIVE HAS MAJOR IMPROVEMENTS

By BRUCE W. WADMAN

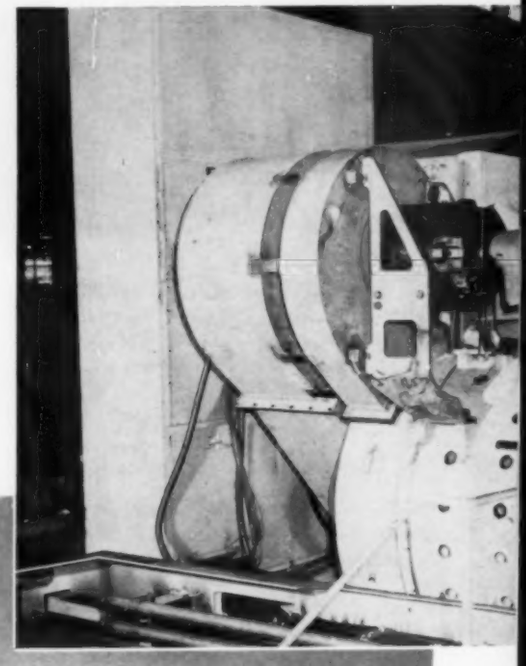
HIGHER tractive effort, reduced maintenance, increased power efficiency and dynamic braking capacity are four of the principle features highlighting a new combination high speed and heavy drag general purpose locomotive introduced by GM's Electro-Motive Division in mid-October. Among some of the 30 major structural and operational improvements are a new central air filtering system, greater fuel capacity, and a new, simplified electrical apparatus.

The new locomotive, designated the GP-30, is a four-motor, four-axle unit. It was introduced to some 100 railroad officials at GM's Technical Center outside Detroit. The GP-30 is powered by EMD's latest, most efficient version of its turbocharged model 567 diesel engine.

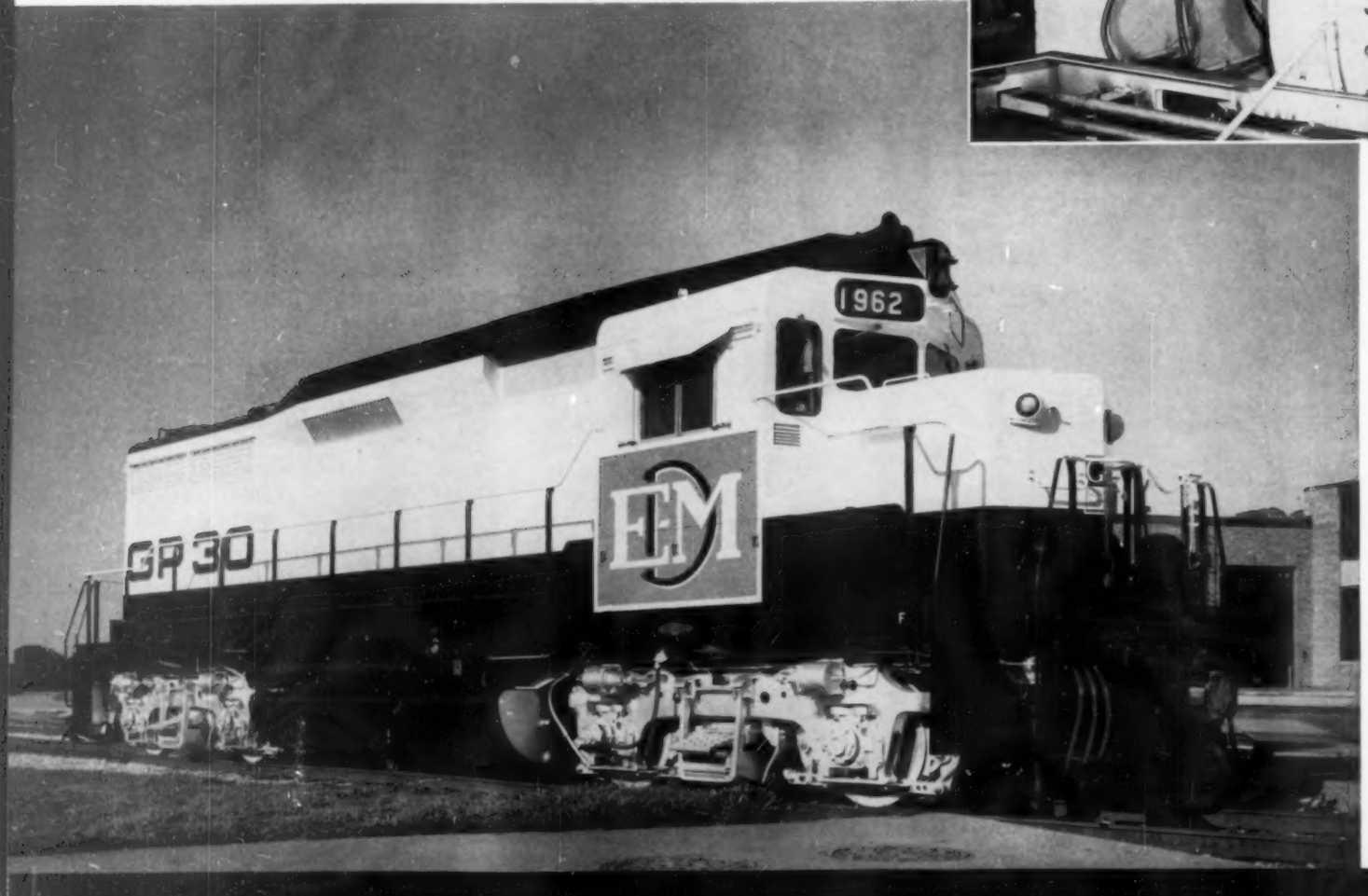
Capacity of this new diesel version, the 16-567D3, has been increased 12½ per cent by several improvements to supply 2,250 hp at the flywheel at 835 rpm while improving life expectancy of wearing parts. This has been accomplished by a new fabricated 15 port cylinder liner with a 23 per cent increase in porting area for better breathing and fuel economy; a completely new design piston and a needle valve injector. These modifications have led the way to improvement of the specific fuel consumption to .366 lbs./bhp/hr., at 90° air temperature. This is a 10½ per cent improvement over the .404 lbs./bhp/hr. of the model C non-turbocharged model. This turbocharged design has been improved to give even greater life and still maintain the feature of being mechanically driven at low speeds and free running at high speeds. The arrangement results in a very low loss of horsepower at altitudes. Thus, for instance, the 567D3 will maintain its full rated horsepower up to 6,000 ft. and maintains 97 per cent of rated horsepower at 9,000 ft. Improved combustion in the turbocharged engines plus the seven-element full flow lube oil filter will allow running from 60 to 90 days between changes instead of the usual two weeks on non-turbocharged equipment, according to EMD.

The turbocharger lube oil pump now starts automatically when the engine is started to supply oil to the turbine bearings during startup; then it shuts off. This pump is automatically started again for soakback operation when the engine is shut down and operates for 15 minutes to remove heat from the turbine bearings.

The locomotive engine also has an absolute air box pressure sensing, rebalancing governor to regulate correct fuel-air ratios for proper com-



New Electro-Motive Division GP-30 locomotive features 2250 hp model 16-567D3 diesel engine, new central air filtering system.

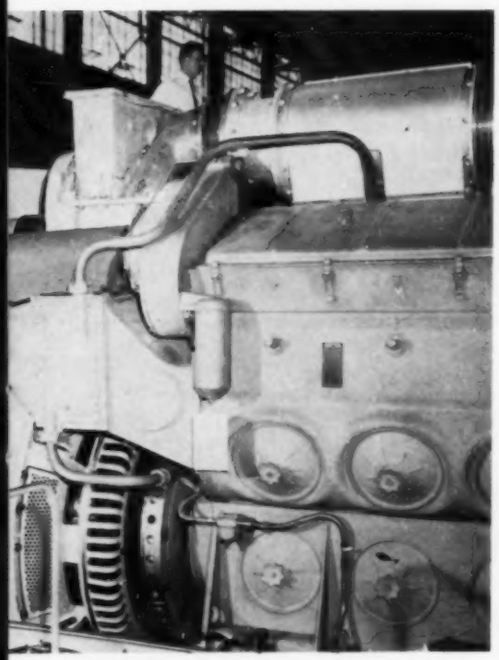


bustion, particularly at high altitudes and in tunnel operations. The engine is in the center of the locomotive to provide good balance and eliminate the need for ballast. The fuel tank is directly under the engine. Thus the locomotive is inherently balanced.

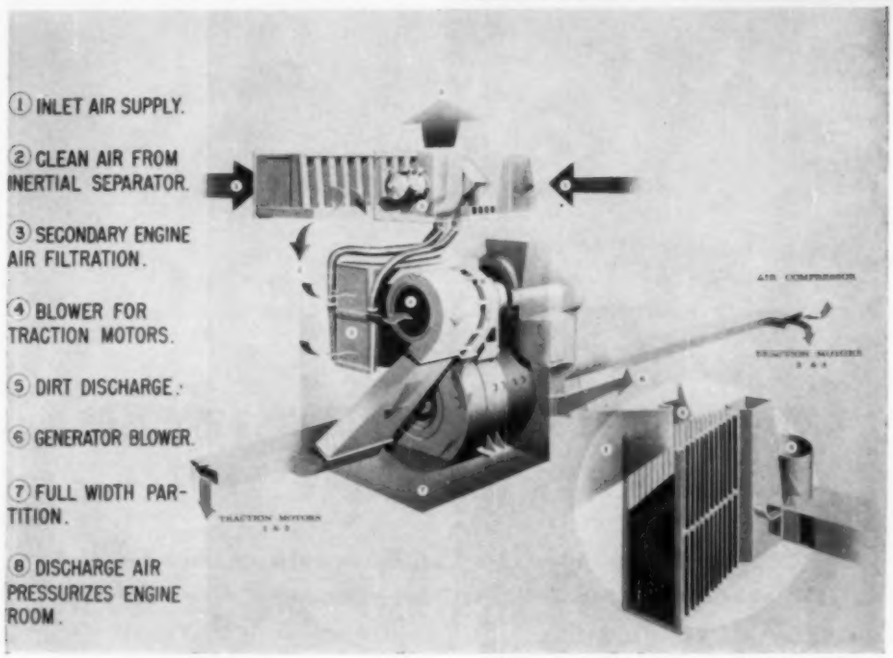
EMD has designed a new central air filtering system for the GP-30 that contributes to the greater operational efficiency of the new units. Conventional carbody filters have been replaced by a self-cleaning inertial type filter. Final filtration for the engine is provided by a Farr Rotonamic filter which is also self-cleaning. This combination eliminates filter maintenance except for annual inspections. Further reduction in maintenance is obtained by elimination of four electric traction motor blowers.

was drawn through carbody filters and wiped across the engine, picking up oil film and heat before it was taken into the engine intake filter. In the filtering system, the inertial filter at engine full load conditions takes approx. 31,000 cfm of air. Of this, 9,000 cfm is utilized by the engine, 7,000 for generator cooling and engine room pressurization, 12,000 for the traction motor and air compressor cooling and 3,000 is used for dust removal to the atmosphere. The combined filtration efficiency of this system is comparable to the previous system of carbody filters and similar engine intake filter.

Unitized control stand combines air brakes and locomotive controls in one panel, simplifying operation.



Model 16-567D3 diesel driving generator GP-30 has specific fuel consumption of .366 lbs./bhp/hr.; turbocharged unit has lower preventive maintenance requirements than previous models.



Schematic diagram shows new central air filtering on GP-30. Air from intertial filters receives final filtering through Farr Rotonamic unit before entering engine.

Here's how the system works: Air is admitted at the top of the locomotive on both sides where airborne dirt is at a minimum. It passes through a row of filters which separate the dirt from the air by inertial forces. Combustion air for the engine receives secondary filtering through the Rotonamic centrifugal filters. Dirt separated by the inertial and centrifugal cleaners is forced out through a roof duct by a small motor driven blower. Clean cool air for the traction motors and air compressor is supplied through ducts by a mechanical blower.

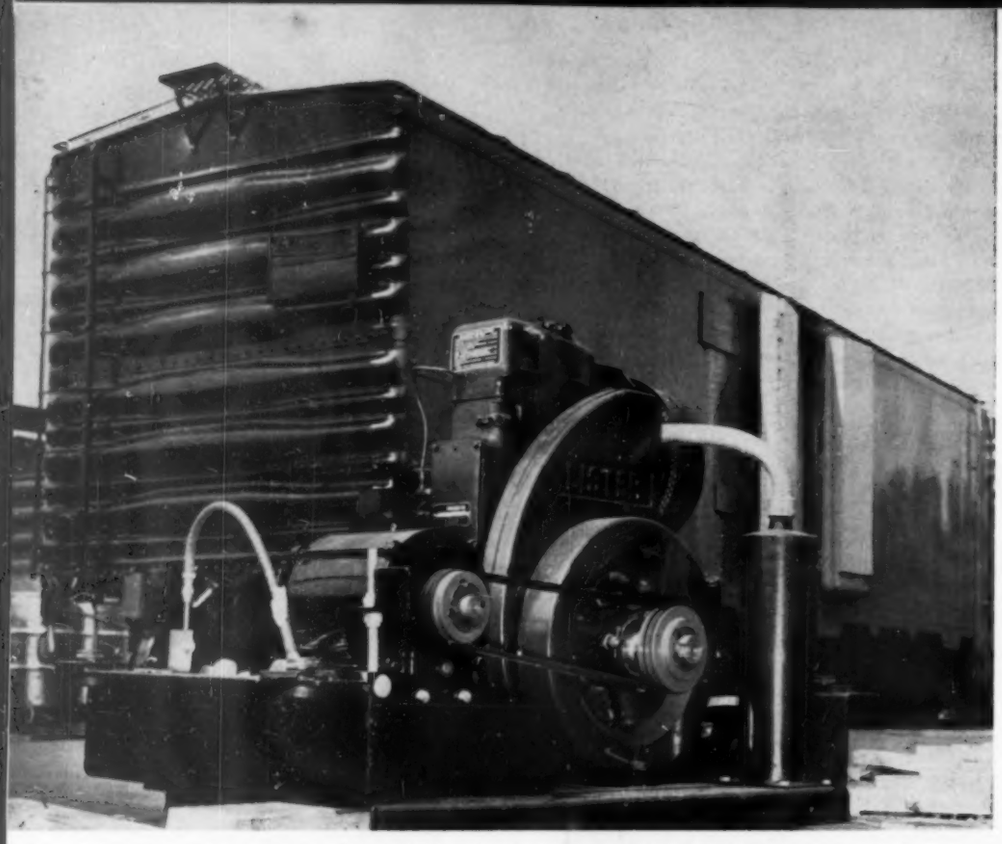
A second blower provides filtered ventilation for the main generator. The engine room is partitioned at the generator and air leaving the generator is ducted through the partition to pressurize the engine room, assuring a clean engine room. Clean ambient air is also supplied to the sealed high voltage cabinet permitting dust-free operation of its electrical components. In previous designs, engine air

A new D-57 traction motor, with new style banding, bearings, commutator and cooling, results in a 27½ per cent increase in the operating range of the GP-30. At 12 mph, the continuous tractive effort of 50,000 lbs, represents a 21 per cent improvement over the previous model based on a top speed of 71 mph. Fuel capacity has been boosted to 2550 gals., up 9 per cent. Overall dimensions of the locomotive . . . 56 ft. 2 in. x 10 ft. 3½ in. x 15 ft. . . . remain unchanged despite the large increases in capacity.

A one-third increase in dynamic braking capacity has been built into the GP-30. Special control circuitry also available allows extension of the maximum braking capacity, which now occurs at 21 mph, down to 4 mph, making the dynamic brake an effective stopping as well as holding and slow-down brake.

The GP-30, according to Richard L. Terrell, GM vice president and general manager of Electro-Motive Division, has a base price of $197,500. This represents a cost of $86.89 per horsepower, substantially below the $90 per horsepower figure for the FT locomotive introduced in 1947 and the $97.50 cost for the GP-7 on introduction in 1949. In addition to the lower price, Terrell pointed out that some features formerly charged as extras are now included in the basic GP-30 locomotive, adding significance to the reduced cost figure.

"An important economic feature of the GP-30 is that it can be purchased through EMD's replacement plan with certain long-life pieces reused in the new locomotives," said Terrell, at the Detroit showing. "With introduction of the GP-30, economy of the replacement plan has been improved about 20 per cent compared with preceding replacement models." By turning in an old GM 1500 hp locomotive (12 to 16 yrs. old), for example, for a new GP-30 replacement, the customer's out-of-pocket cost is $54,600 less than outright purchase of a comparable unit.



Lister SL 1, 4 hp air-cooled diesel engine waits installation beneath PFE "Ice-Tempco" car, rear. 1000 of the dieselized ice bunker cars, with Lister and Petter small engines, have rolled from PFE's Los Angeles shops since June.

PFE BUILDS DIESELIZED ICE BUNKER CARS

1000 Cars Converted To Use Underslung, Air-Cooled Diesel-Generator Sets for "Ice-Tempco" Cars Which Cut Ice Requirements and Increase Payload While Holding Temperatures at 30-70° F

By JAMES JOSEPH

UNDERSLUNG air-cooled diesels . . . a precision fan-and-thermostat temperature control system . . . and 7000+ pounds of ice. They combine to hand big Pacific Fruit Express railroading's only thermostatically-controlled, continuously self-powered ice bunker car, the "Ice-Tempco", a new word on the rails but one which PFE shippers coast-to-coast are happily adding to their lexicon of superlatives.

And at PFE's Los Angeles shops, where 1000 of the car-conversions were completed in late November (five months after the rebuild program began), railroad men are just as loud in their praise for a car which not only handily beats the heat (holds preset temperatures, from 30° to 70° F, within 2-degrees) but which, thanks to its compact, undercar diesel (either the air-cooled Petter PC 1 or Lister SL-1) packs its own power plant.

Diesel efficiency and precision temperature control have enabled PFE to eliminate one of two end-car ice bunkers (converting it to cargo space), cut by nearly 4000 lbs. the ice normally carried by non-dieselized bunker cars . . . . and up payload capacity more than 10 percent (from 1988 cu. ft. to 2248 cu. ft.).

"Ice-Tempco" is a word coined by PFE, which likewise supplies its definition: ". . . a standard refrigerator car with one bunker only and thermostatically controlled fans and dampers operated by electrical power . . . furnished by diesel."

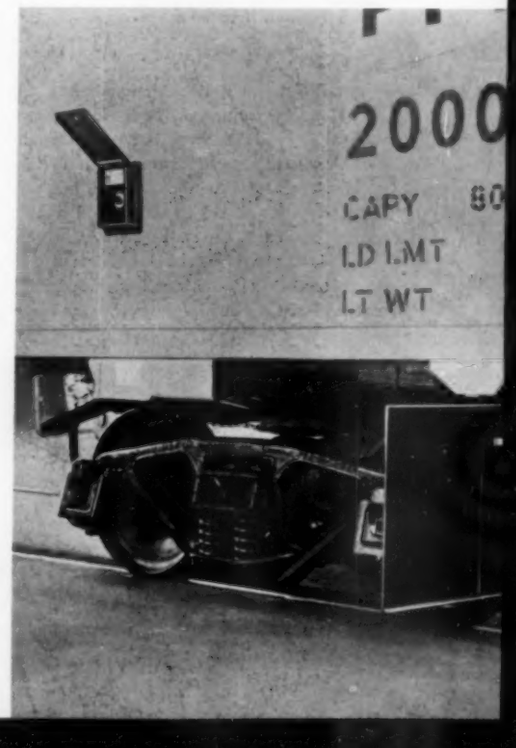
Ice-Tempco cars include some other newities, too. In refitting its 1947-built R40-23 series bunker cars (all are 40 ft. long), PFE re-insulated them with 4½ in. of Styrofoam, installed new ultra-low floor racks (which increase inside loading height by fully 2½ in.), reworked underframes to assure a bonus 10 years of service life, and converted the one remaining ice bunker bulkhead into a kind of fan panel. The panel, with its four fans, their electric motors and actuator-controlled dampers are the keys to in-car temperature control.

"But," says one PFE shopman, "the diesels have made the big difference." And dieselization has. Pre-diesel, ice bunker cars and their circulating fans went literally dead when a car stopped, either for loading or switching. Fan power, strictly mechanical, was geared to a wheel take-off. When cars weren't rolling there was no "power". Moreover, pre-cooling presented a kindred problem. Sidetracked for loading, a car couldn't automatically pre-cool itself (as do the new Ice-Tempcos). Either a shipper or PFE had to roll up auxiliary power to pre-cool.

The revolutionary Ice-Tempco, carrying its own power package, pre-cools itself on demand, holds lading temperatures whether the car is rolling or sidetracked, and hands PFE and its shippers the kind of temperature control never before attained with ice as the "refrigerant". Thus, the refitting program, begun in June this year and since rolling at the rate of six car completions a day, upwards of 30 weekly, adds new life (10 years at least) and new utility (precision temperature control) to ice bunker cars.

Of the 1000 "Ice-Tempco" units completed during PFE's 1961 refitting program:

• 700 are temperature-systemed by Preco Inc. The system, which Preco dubs "Cargotemp", mounts four 4-bladed fans (two designed to continuously circulate lading-area air, two for cooling) in the ice-compartment's bulkhead. The electrically powered fans and their dampers operate from a Preco alternator located beneath the car and belt-driven by an air-cooled diesel "compact", which operates continuously. 500 of the engines are Petter model PC-1's, rated 3.7 hp at 2200 rpm. 200 are Lister model SL-1, rated 4 hp at 1650 rpm (operating speed: 1640 rpm). Both diesels are fueled from a 60-gallon tank, likewise "underslung", the tankage sufficient for upwards of 15-days' continuous running. The Preco alternator



supplies 38 volts ac, 3-phase, to operate fan motors, fan-damper actuators and the Partlow thermostat which controls them.

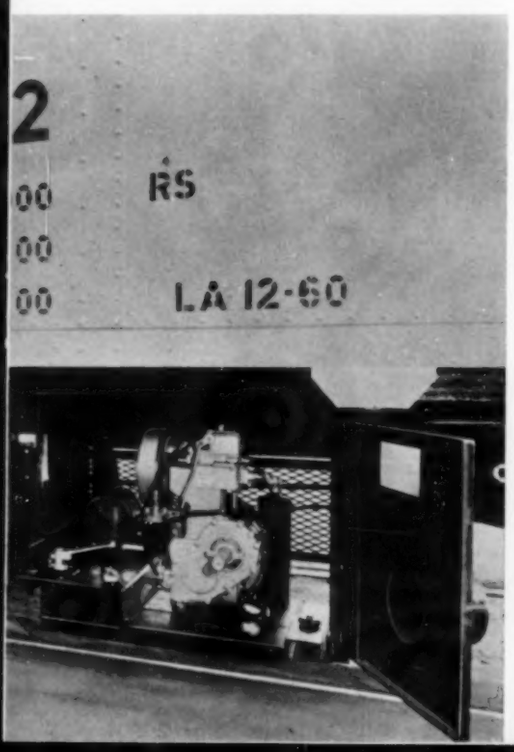
● 300 of the cars are installed with Equipco Co.'s "Ice-N-Air" system, likewise built around a self-contained diesel-alternator underslung power package, bulkhead fans and Partlow thermostat control. All 300 Equipco alternators (38 volts ac) are belt-driven by Lister SL-1's.

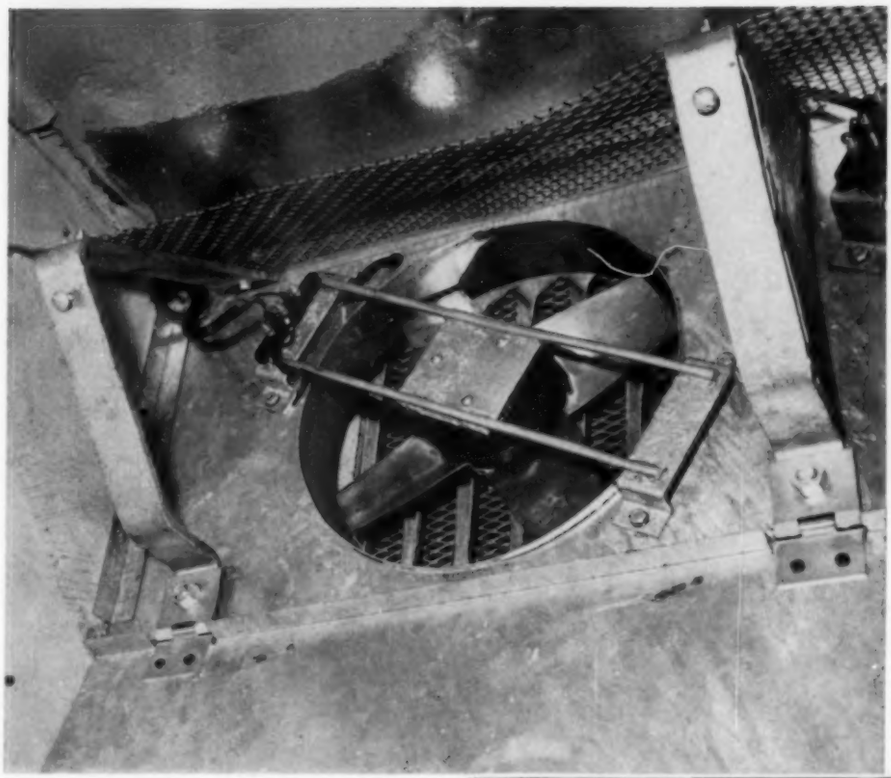
PFE's Ice-Tempco concept assigns two of the bulkhead fans to continuous lading-air circulation, the airstream bypassing the ice bunker. The remaining two fans are "called" into service at the command of the thermostat and its temperature-sensing mercury bulb located in the by-pass return-air bulkhead channel. The thermostat thus "senses" the temperature of the cargo-return airstream.

Typically, Preco's Cargotemp system involves two separate in-car "airstreams"—and their control. One "airstream" pulls air continuously from the entire lading area via two of the bulkhead fans (which operate at about 3000 rpm). In "bypassing" the ice bunker, this lading airstream routes thru the special duct located within the bunker bulkhead. Thus the airstream, both go and return, bypasses the bunker and bunker ice.

The other "airstream"—dubbed the "cold airstream"—is forced thru the iced bunker until the sensing bulb signals "cool enough". Then the thermostat triggers a relay which in turn shuts off the two cold-air fans and, at the same time, automatically closes their dampers. Dampers prevent cold bunker air from invading the lading area . . . as it might thru natural air convection.

During the winter, when heating rather than cooling is required for such cargo as potatoes (42° F), lettuce (34° F) and tomatoes (56° F), a methanol-fueled cargo heater (12,000 Btu per hour) is substituted for ice in the bunker. And the thermostat works in reverse: bunker "airstream" fans are *shut-down* when the cargo temperature *rises* to the pre-set—and desired—temperature.





One of four bunker bulkhead fans, its motor powered by diesel-driven alternator, actuates at command of thermostat. Damper seals fan when fan is shut-off to prevent cold bunker air from reaching cargo.

Partlow thermostat and its preset control are housed on side of car above engine compartment. Thermostat can hold temperatures within 2 degrees, and between 30-70° F.

"Ice-Tempco" cars roll from Los Angeles shop. These are first rigidly controlled ice bunker cars . . . and first to pack their own power supply (diesel engine, alternator and thermostat, all "underslung"—mounted beneath car). Unit at left has Petter PC-1 engine rated 3.7 hp at 2200 rpm which drives Preco alternator.

The "underslung" diesel-alternator package is itself an oddity to refrigerated car service—and bids, both for mechanical reefer and ice bunker cars, to replace in-car power. Suspended under-car, the power package commandeers no payload space. But not until the air-cooled small engines had proved themselves to railroaders did PFE venture to adopt them. And, not until PFE had a proven small engine was below-car installation possible.

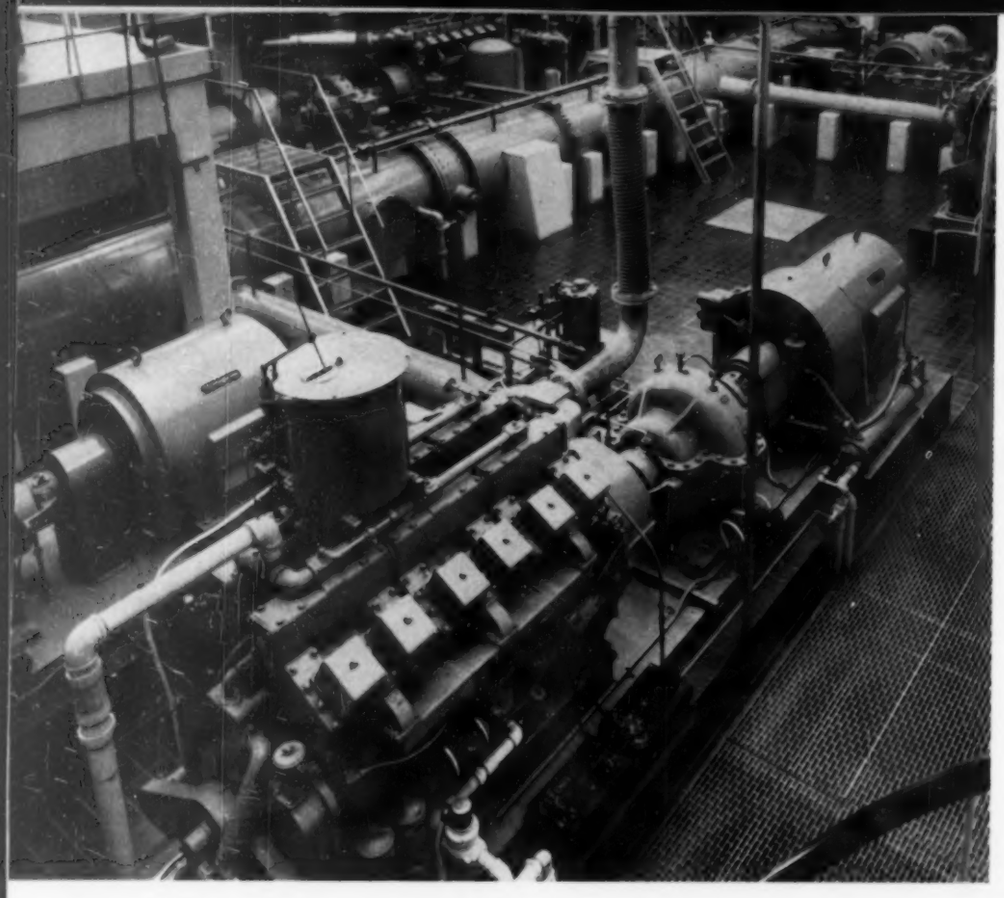
Typical, perhaps, is the Petter PC-1 and Preco alternator "underslung" power package.

Housed in the under-car compartment, the continuously operating small engine belt-drives the alternator which delivers its 38-volts ac to the compartment's power panel, which in turn is controlled (via relays) by the thermostat.

The Petter is shock-mounted (on three rubber mounts), cranked to start, has an overlarge oil sump (holds about 19-quarts of lube oil), and is equipped with a Purolator lube oil filter, a Fram fuel and air filter, Bryce fuel pump and Nelson spark arrestor and muffler. Since the engine is crank-started, it has no batteries, no generator or starter. Nor is the engine protected by low-oil shut-offs, a reason for the overlarge oil sump.

Started during cargo loading (if pre-cooling is required), the little engine runs continuously until, the car having reached its destination and unloaded, it's shut down.

"Some," says a PFE diesel mechanic, "run 15 days without stopping . . . which is about the limit of their fuel supply." So compact and functional a diesel package bids to revolutionize so-called "high temperature" refrigerated rail service—and hand shippers the most precise temperature control yet built into an ice bunker car.



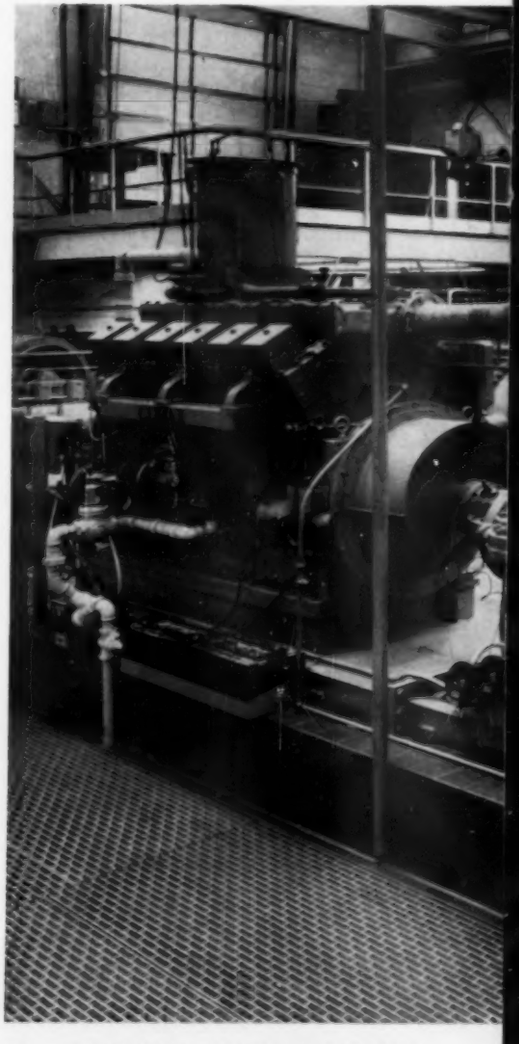
highest speed of 1180 rpm, each pump can deliver approx. 8400 U. S. gals./min., and at the lowest speed of approx. 1050 rpm, each can deliver approx. 2400 U. S. gpm.

Under normal conditions, the pumps are driven continuously by the Westinghouse constant speed electric motors. In this operation, pump speed is varied to suit load conditions by means of Vulcan-Sinclair variable speed hydraulic couplings.

In the event of failure of commercial power, the gas engines are started automatically and take up the pump load through BLM centrifugal clutches. These are Climax natural gas engines, 12 cylinder units, model V-125, of 60 degree Vee construction

Pump is normally driven by constant speed Westinghouse electric motor. Climax gas engine takes over in case of failure of commercial electric power, drives pump at maximum 1180 rpm. Engine speed is controlled by Woodward PG-PL pneumatic-hydraulic governor.

Closeup view of engine-pump-motor setup shows in-line arrangement. Motor drives through variable speed hydraulic coupling. The 12 cylinder, Vee-type, model V-125 Climax gas engine is rated 484 cont. hp at 1200 rpm.



AUTOMATED GAS ENGINES PROTECT PUMPING STATION

A fully automated controls system, teamed with ntaural gas engines, provides standby protection for a new pumping station of the Winnipeg, Manitoba, Canada, Water Works System. The Winnipeg installation is at the W. D. Hurst pumping station, operated by the city government and completed just over a year ago. Fully automated, machinery at the station is started and stopped by means of supervisory controls located at another pumping station in another part of the city.

Basically, machinery at the new station consists of three pumps, manufactured by Babcock- Wilcox & Goldie McCulloch, Ltd., each driven from one end by a constant speed electric motor and from the other end by a natural gas engine.

Because the city of Winnipeg does not employ a system of gravity reservoirs, pressure in the water mains must be automatically controlled by changing the speed of the pumps to suit the demand. At

W. D. Hurst station of Winnipeg Waterworks system is adjacent to reservoirs. Engines in station are started automatically in case of failure of electric power to pressure-maintaining pumps.

The pumping units are housed in this new structure, maintain pressure in Winnipeg system, which does not utilize gravity reservoirs.

with bore and stroke of 7½x7 in. and a piston displacement of 3711 cu. in. At 1200 rpm, each engine develops, on natural gas fuel, a maximum of 605 bhp, or, for continuous service, 484 bhp. Because of the short stroke, a very favorable piston speed of 1400 fpm is possible at 1200 rpm.

The speed of the engine, unlike that of the electric motor, is variable to match pump output to pressure demands. Constant pressure is maintained in the mains through engine control by a Woodward model PG-PL pneumatic-hydraulic governor. An air signal varying in strength from 3 to 15 psi is delivered to the Woodward governor so that the engine operates at its maximum desired speed (1180 rpm) when the signal is at 15 psi and at minimum speed (approx. 1050 rpm) when the signal is at 3 psi. Infinite speed modulation between these two points is determined by pressure of the signal delivered to the governor. Strength of this signal is controlled by discharge main pressure.

For the first several months that the engines were installed at the W. D. Hurst station, commercial power was not yet available so the natural gas units were operated continuously. Performance during this period was rated quite satisfactory.

Each of the Climax V-125 engines is equipped with a Synchrostart model 3434 automatic control unit together with a power failure relay. This control combination operates as follows:

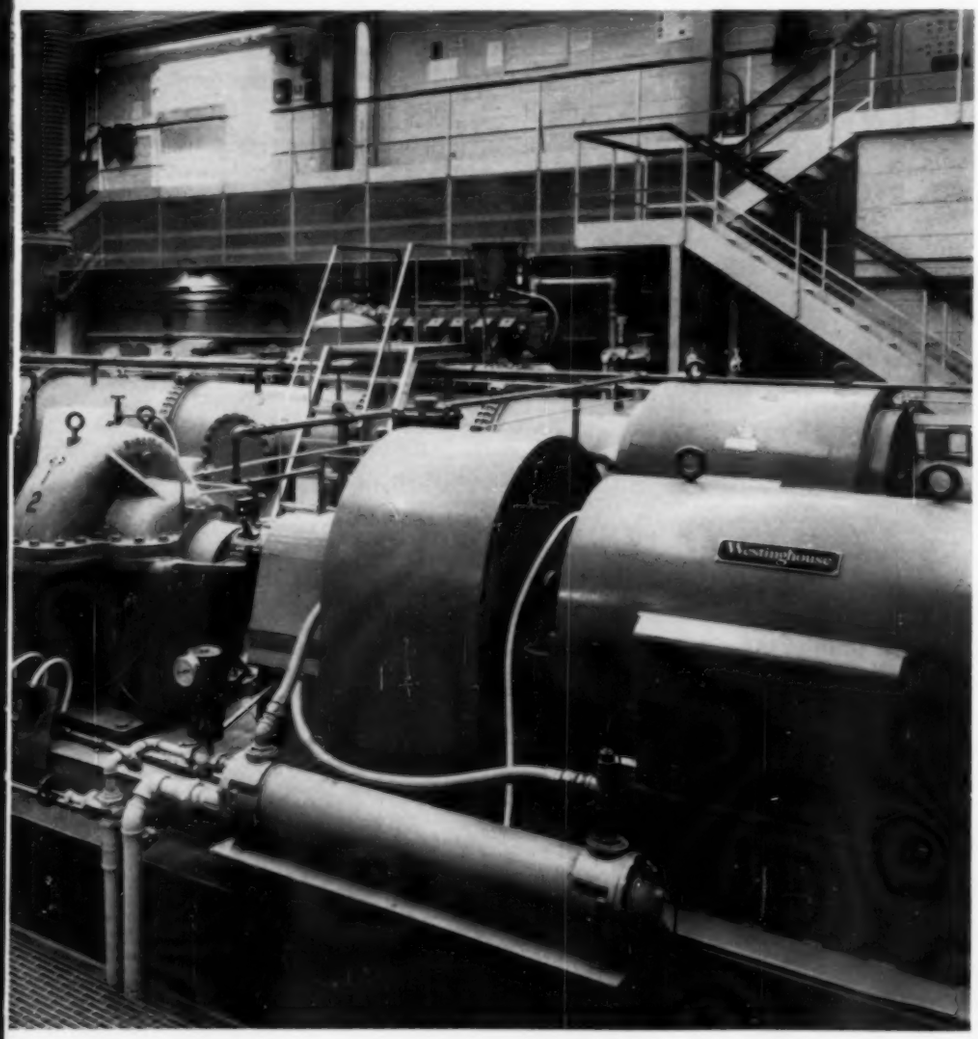
1. At the moment of power failure, the power failure relay closes a contact which initiates the cranking cycle.

2. When the engine fires, the starting motors are de-energized by means of buildup of the battery charging generator voltage.

3. On return of commercial power, the power failure relay opens and the Synchrostart unit de-energizes the throttle solenoid.

   The speed of the engine then drops to idle at a speed below the engaging point of the centrifugal clutch. At the same time, an auxiliary relay in the control unit prevents the electric motor from starting until the centrifugal clutch is disengaged.

4. The engine continues to idle for two minutes to cool it off, it is then stopped.



Engine jacket water cooling is by means of a Ross model 804 CPR single pass heat exchanger. The raw water flow to the heat exchanger is controlled by means of a Powers thermostatic valve which serves the dual functions of limiting the flow of raw water to that actually required by the engine at any load condition and also stopping flow of the raw water when the engine is at rest. The fuel system on the Climax engines consists of an Ensign model DG natural gas carburetor on each bank of six cylinders. Each carburetor is fitted with an Ensign type B secondary fuel regulator. Starting is by means of a 24 volt cranking motor and generator. The battery bank includes two Exide 12 volt batteries in series.

The control scheme is designed so that the plant can be run completely unattended with a remote monitoring and control board at another pumping station. The overall control system was designed by James F. MacClaren and Associates of Toronto. The basic engine control setup, for operation in conjunction with the master control units, was designed by Atlas Polar Co., Ltd., also of Toronto, working with MacClaren and the engine builders.

FUTURE OF HIGHER HORSEPOWER ENGINES

Many Factors Now Influence Design of Road Vehicles and Power Plants; Diesel OTR Tractors to 750 HP Expected in 1970's with 300,000 Mile/Year Operation

By KENNETH W. SELF*

SINCE the very beginning of transportation, the vehicle and roadway have progressed hand in hand. As new means of vehicular transportation came into being in one area, they spread to others, and trails, roads and eventually superhighways were built to accommodate them. Many factors have been important in establishing the truck as a means of inland transportation over great distances—the development of the internal combustion engine, progress in road building, the impetus of the World Wars to name a few. With the increasing number of trucks, regulation became necessary and thus the Interstate Commerce Commission was born, as well as state regulating bodies. Since that time, their regulations have controlled the design and development of highway equipment to a large extent. In addition, at least three other factors are influencing present and future truck design: the national highway program, the operation of double-bottoms on the turnpikes, and AASHO road tests.

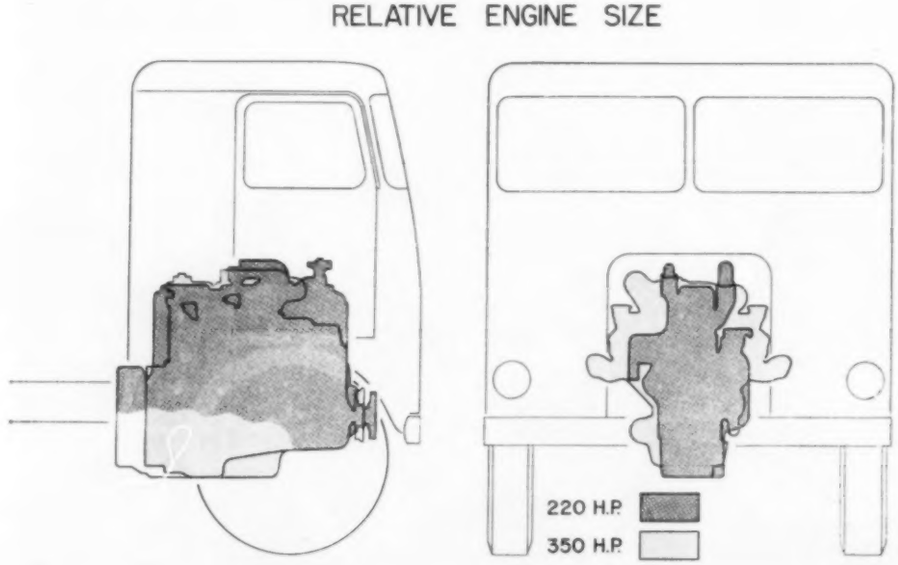
Kenneth W. Self

The national highway program is the first really planned effort to provide adequate highways on a national basis. Scheduled for completion in 1972, these highways will be flatter, straighter, with limited access, increased speed limits, and much shorter running times. What will be their effect on truck operators? We can expect, by 1965, that all states will permit a 72,000 lb. gcw, with a tolerance to permit 73,280 lb. on all highways in the new interstate system. This is the maximum weight limit set by the Federal government, with the exception of those states that have permitted higher gross loads before the passage of the interstate act. Since most of the Western states are already up to these limits, the greatest change in the immediate future will be in the Midwest and Eastern states.

The second factor influencing truck design today is the operation of double 40 ft. trailers on the turnpikes. Because of the tolls imposed for running on the turnpikes plus fuel tax and other taxes, truckers were bypassing the toll roads, resulting in a considerable loss of revenue. Analyzing the problem, the toll road authorities decided to remove certain artificial barriers and allow the carriers, on an experimental basis, to pull two 40 ft. trailers as a doubles combination, similar to the West Coast practice of pulling two 27 ft. trailers. The legal gcw was raised to 127,000 lb. at a maximum overall length of 98 ft. Operation of doubles on the toll roads has been successful and some toll roads have adopted these new standards on a permanent basis. Others are running similar tests.

A third factor that will influence truck design over the next few years is the AASHO road test now in progress. It will be completed and reports submitted to Congress soon. These tests will show the effects of axle loading on various types of highway construction and will help answer the questions as to what percentage of the cost of highway construction and maintenance the trucks should bear.

Fig. 1 is divided into three sections showing average gcw for the years 1953, 1961, 1965, and 1975: the average speed limits; and the horsepower required in the West, the Midwest, and on the turnpikes. The 1953 and 1961 figures are actual; 1965 and 1975 are estimated limits. Note that gcw has increased only slightly since 1953, but it is predicted that during the next 15 years maximum limits will nearly double. Average speed limits have increased only 4 mph, but will probably increase over 12 mph by 1975. Horsepower required has



Relative engine size—schematic compares installation of 350 hp V-8 diesel with heavy-duty 220 hp in-line 6.

*President, Freightliner Corp. This is condensation of SAE paper presented at recent West Coast meeting.

New White Freightliner COE tractor is powered by 350 hp V-type diesel, 15½ in. two-plate clutch and 12-speed transmission. All Freightliners are custom built to meet customer's individual requirements.

increased about 50% from 1953 to 1961 and will more than double by 1975. Because of minimum speed limits in mountainous terrain, horsepower requirements in the West will far exceed the requirements of the Midwest and East. The maximum of 750 hp will be required if a speed of 30 mph is to be maintained on a 5% grade with a gross load of 130,000 lb.

There are several cost factors involved in choosing an engine of the proper horsepower for a particular job, as shown on Fig. 2. The greatest of these are fuel and driver costs. Higher running speeds will result in higher fuel consumption and a reduction in driver cost, one offsetting the other to a certain extent. Even though driver costs in some cases at the present time are based on mileage, an increase in speed and a reduction in running time should result in lower driver cost per mile over a period of time.

Because all costs do not increase as equipment is operated more miles per year, there are some economics in increasing equipment utilization and operating a power unit more miles per year. In choosing an engine—or the horsepower of an engine—for a particular job, the best common denominator is cost per ton-mile of freight hauled. Table 1 summarizes the cost per mile of operating a typical tractor-semi-trailer combination hauling 72,000 gross at 150,000; 210,000; and 300,000 miles/year; and a 40 ft. trailer doubles combination hauling 130,000 gross at 300,000 miles/year. Operating equipment more miles per year will be fairly easy to accomplish on the new highways. It will be possible to maintain a cruising speed at the legal limit a majority of the time, and average running speed will be much closer to the top speed than at present. Thus, operating a piece of equipment as much as 300,000 miles/year on the longer runs is not at all impossible.

Increasing gross loads is not quite as simple, because changes of legal gross loads and vehicle size and length must wait for legislative changes. The trend to lighter weight equipment will continue in the future, as it has in the past. Light weight becomes more important as length, height, and width increase, providing greater cube. Revenue can be increased by saving weight in the equipment only of course if more freight can be hauled. We can also expect an increase in vehicle width within the next few years—probably to 108 in. House trailers 10 ft. wide are now permitted on the highways in some states. The increase to wider equipment will probably first come on certain highways in the Western states.

Now let us take a look at the engines themselves. Higher horsepower can be accomplished by several means—greater displacement, higher engine speed, and turbocharging. These, of course, must be consistent with fuel economy which has been and will continue to be a major factor in engine choice. Increased displacement through V-type configurations, and turbocharging are two of the major design trends today. Both can result in the increased output required while at the same time maintaining or improving upon present fuel economy rates. The Vee engine offers the highest horsepower with less weight, and its compactness is particularly important as it regards length. Note the schematic which illustrates the relative size of one manufacturer's compact 350 hp V-8 as compared to its heavy-duty in-line naturally aspirated 220 hp diesel.

Both 60 and 90 degree Vee configurations are being built today for truck service and the short stroke type is being turned at higher rpm with the same on lower piston speed. While speeds at one time were almost standard at 2100 rpm, the range has now broadened considerably and ratings are based on speeds from 1800 to 2600 rpm. The important consideration is that these diesels have available added rpms for short periods which provides a way of getting increased horsepower for picking up gears and maintaining speed on hills—then cruising the engine at more moderate rpms for improved fuel economy and long life.

In the immediate future the biggest demand for high horsepower engines will be on the toll roads, pulling 127,000 gcw on double 40 ft. trailers. The number of power units on the toll roads will be small compared to the total trucks used on all highways, with the number of high horsepower tractors increasing gradually. I expect the majority of the long-haul intercity tractors in the next 10 years will meet the same horsepower requirements as the present turnpike tractors, with a minimum of 280 hp, an average of 500, and up to 750 hp in the mountainous runs of the West. Minimum speed limits on grades will govern the horsepower required.

At the present time there are several V engines in use or on test in highway trucks—both 4-cycle and 2-cycle engines running from 200 to 430 hp. We can only speculate on the size of the long-haul highway equipment by 1975. Additional cube can be accomplished either by wider equipment, combinations of more units—two 40 ft. trailers or three 27 ft. trailers. The gcw will be somewhere between the present legal limits and the 130,000 gross on many major highways.

This sounds like a drastic increase in horsepower and gross combination weight until you look back over the last 15 years. Fifteen years ago the predominant engine was 150-165 hp. At that time the diesel highway tractor was only about 15 years old. We can expect, with the know-how and foresight of the diesel engine industry, that the advancement of engines will continue at a stepped-up pace. New engines will be even lighter with respect to the horsepower produced. They will operate at greater engine speeds during peak horsepower requirements and at lower speeds for maximum fuel economy during lower horsepower requirements while cruising on level highways. Speed limits by 1975 will probably be 65 mph on straight, flat highways with lower limits on mountainous or hazardous stretches.

	TRACTOR 40' SEMI	TRACTOR 40' SEMI	TRACTOR 40' SEMI	TRACTOR 40' DOUBLE
GCW - LBS	72000	72000	72000	130000
PAYLOAD - TONS	23	23	23	44
MILES / YR	150000	210000	300000	300000
COST - ¢ PER MILE				
DRIVERS	6.00	6.00	13.82	8.20
MAINTENANCE	7.23	7.23	7.33	9.53
FUEL (INCL TAX)	4.78	4.78	6.30	8.46
DEPRECIATION	3.47	2.47	1.80	2.70
TIRES	1.80	1.80	2.54	4.16
DIRECT TAXES	1.58	1.44	1.35	1.90
OIL	0.20	0.20	0.26	0.35
TOTAL - ¢ PER MILE	25.06	23.92	33.60	55.80
¢ PER TON MILE	1.090	1.040	1.460	1.270

Table 1—Representative direct cost of line haul equipment.

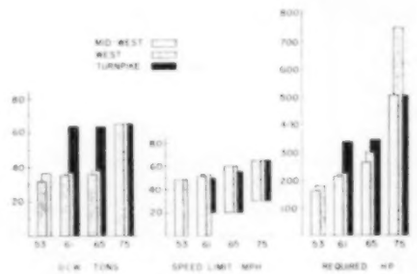


Figure 1—Trends of gcw, speed and horsepower.

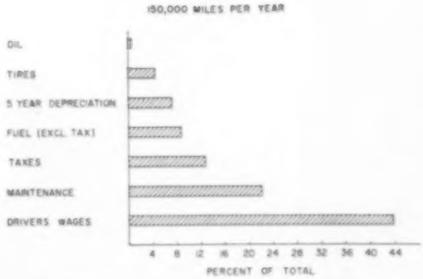


Figure 2—Typical direct cost of line haul tractor, 150,000 miles/year.

MUNICIPAL PLANT LOGS 50TH YEAR

Sebewaing, Michigan Village-Owned Electric Plant Operates Five Diesels For Power Generation; Newest is An F-M 1440 HP, 6-Cylinder Opposed Piston Engine; First of Its Type Installed in a Power Plant

By J. W. BROWN

THE first recorded instance of street lighting for Sebewaing (pronounced Seeb-ewang) Michigan dates back to 1885 when the village council ordered one oil lamp to be lighted every night—"at each end of the bridge." But to dispel the darkness on a more efficient scale, electric arc lights were installed in 1901. These were served by a private power company on a 10-year contract until 1911. Dissatisfied with the cost of this service, however, the Sebewaing village council investigated the cost of a light plant and in 1911 decided to erect a municipal plant. A site in the downtown area was purchased for $175; a Fairbanks, Morse equipment bid of $4,672 was accepted and arrangements were made for a building to be erected and poles to be installed. The original light plant cost, including land, machinery and building, was $17,146.34.

Starting out on this modest basis, the village of Sebewaing found itself the owner of its own light plant. True, it was only a "dusk to dawn," operation at first, (with special charges for all who wanted electricity after midnight), but the two oil-burning engines, one 20 hp and one 50 hp, struggled valiantly to keep up with the growing demand. An additional Fairbanks-Morse engine was purchased in 1921 and in 1923 a Fairbanks-Morse proposal for light plant modernization to ac generation and distribution was accepted and ratified by the council.

Today the Sebewaing Municipal Light Plant has five diesel engines installed with a total horsepower rating of 5,540 and a total maximum electrical output of 3,850 kw. Here they are in the chronological order of installation, and with the record of their usage up to about October 1, 1961:

Fairbanks-Morse, 525 hp 350 kw, Installed, 1933. Hours run, 75,377.

Fairbanks-Morse, 530 hp 350 kw, Installed 1938. Hours run, 94,009.

Fairbanks-Morse, 1280 hp, 900 kw, Installed, 1947. Hours run, 30,469.

Superior, 1765 hp, 1250 kw, Installed, 1954. Hours run, 26,751.

Fairbanks-Morse, 1440 hp, 1000 kw, Put "on line" March 28th, 1961. Hours run to Oct. 1: 1,385.

Perhaps the two most interesting units in the Sebewaing power "stable" are the 1938 Fairbanks-Morse generator set which has run over 94,000 hours (and is said to be every bit as efficient today as it was 23 years ago when it first went to work) and the new model 38D 8½, 6 cylinder, opposed piston turbocharged engine the latest installed.

The new six-cylinder Fairbanks-Morse engine is one of the first "turbocharged sixes" to be installed for stationary plant service. It is a model 38D8⅛ with an 8¼ in. bore and 10 in. stroke. Of the two-cycle OP type, it is rated at 1440 hp and drives a 1000 kw F-M generator. Turbocharger used is an Elliott and the engine is controlled by a type PG-PH Woodward governor.

The village of Sebewaing ("Crooked River") is a mile square and is largely residential. Situated on a flat prairie (as is most of the Michigan "thumb") the town serves a wide agricultural region as a center for marketing, shipping and provisioning. The main crops locally are beans and sugar beets. The principal industries include a Michigan Milk Producers Dairy; a tool and die shop; two metal-working plants; a brewery; two grain elevators; two cement block plants and a fishing tackle manufacturing plant. Population of the village is approximately 2,000.

In October, when the sugar beets are being harvested, they are stacked in huge piles outside the local Michigan Sugar Co., plant and must be air-cooled by a series of tunnels and fans to prevent

The new Fairbanks-Morse, turbocharged 6-cylinder opposed piston engine and gauge panel with Alnor Pyrometer. In the picture also is Clarence Nimtz, chief operator at the Sebewaing municipal plant. Engine is rated 1440 hp, is equipped with Elliott turbocharger, Woodward governor.

spoilage until winter's cold takes over the job. This requires more power than the sugar company's own generating plant can provide, and the Sebewaing light plant steps in to keep the fans going and protect the industry which is vital to local farmers.

A review of the growth of kwh demand in Sebewaing shows a consistent climb from 3.57 million kwh in 1950 to 8 million kwh in 1960—more than doubling in 10 years. The peak demand has grown comparably, from 810 kw in 1950 to 1850 kw in 1960. The current minimum demand is estimated at about 700 kw.

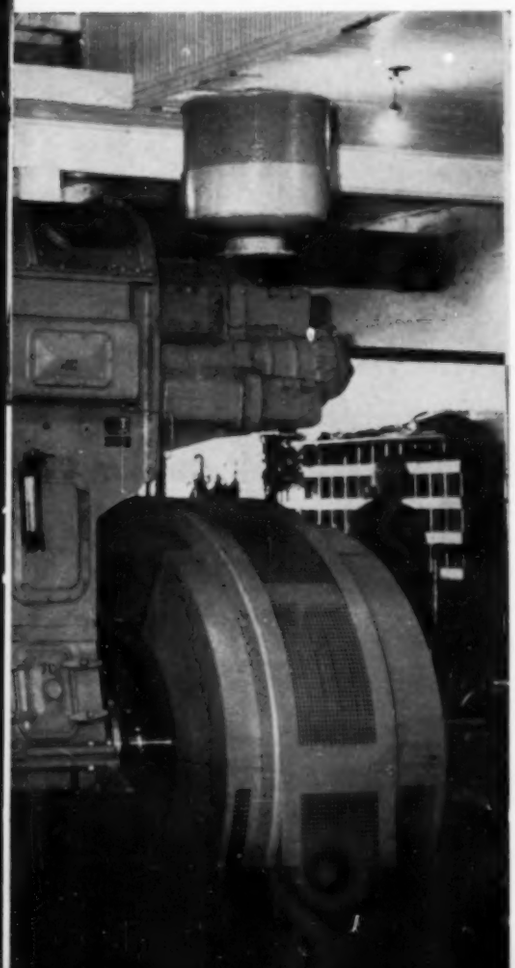
Fuel oil consumed by the Sebewaing plant in 1950 was 630,000 gals., with 4,484 gals. of lube oil used. Kwh produced per gallon of fuel averaged 12.5 during 1960.

The new 1000 kw, 6 cylinder, opposed-piston Fairbanks-Morse diesel generator replaced a 240 hp, 160 kw generator and therefore added 840 kw (over 27 per cent more) to the previous 3,010 kw rated capacity of the plant. According to the plant superintendent, they intend to keep a good "firm power" position, so that with their largest engine off the line they will still have ample capacity, over and above any anticipated peak load.

The Sebewaing plant serves only those homes and farms in or directly adjacent to the square mile area of the city. Under new regulations imposed in connection with financing, they can no longer furnish free street lighting, but they do so at a reduced rate. The light plant and the village water department are under the same administration and linemen from the light plant serve the village also as water department employees. The Sebewaing plant repairs small electrical appliances without charge for its customers and has been largely responsible for the establishment and maintenance of a large recreational park.

Accessory equipment serving the diesel generator sets employed by the Sebewaing Municipal plant is in the basement of the building. Engine cooling water, circulated through heat exchangers, heats adjacent municipal buildings.

One of three Young radiators employed by the Sebewaing plant.



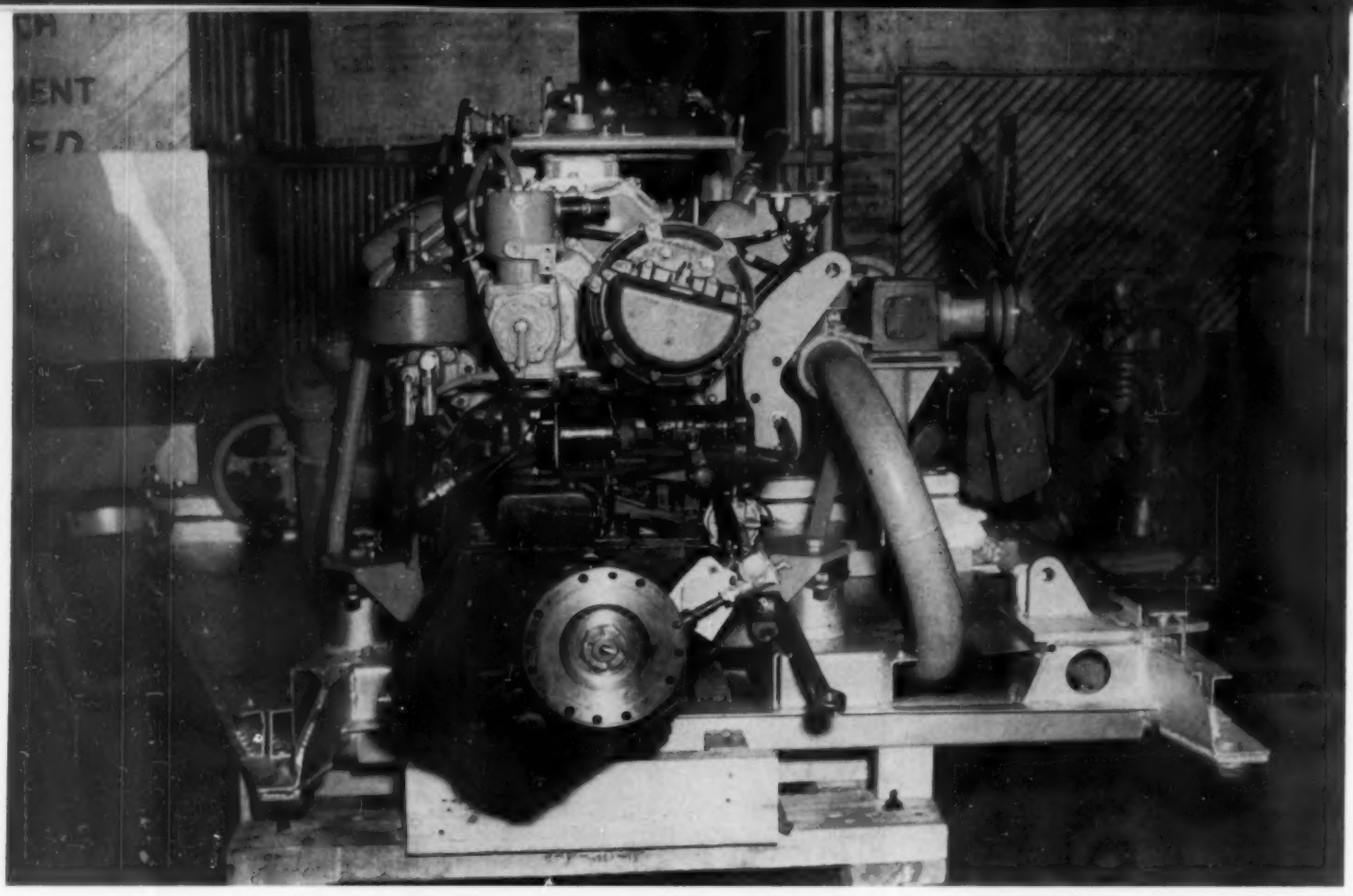
The plant also supplies heat for the municipal building adjacent to it and for the electrical repair shop and garage across the street. It does this by reclaiming heat from the diesel engine cooling water in basement heat exchangers before the cooling water passes into the Young radiators behind the plant.

The Sebewaing power plant is an island of municipal power generation completely surrounded by the service and facilities of a large Michigan utility company. The personnel involved—the village president, village council, the Light and Water commission and the power plant superintendent are immensely proud of having been able to produce the current for lights and power needs for fifty years at reasonable rates for everybody; of having kept their plant equipment well ahead of the demand and operating efficiently; of having served the community well and of being, in effect, another industry in a community where industries are hard to come by.

Plant Accessory Equipment

Turbocharger	Elliott
Fuel oil filter	Commercial
Lube oil reclaimer	Hilliard
Heat exchangers	Ross
Temperature regulating valves	Amot
Pre-lube pump	Roper
Radiator systems	Young
Silencers	Maxim
Control panel	Allis-Chalmers
Governor	Woodward
Pyrometer	Alnor
Air Filters	Air Maze

Sebewaing Light and Power Commission: Village President Arthur C. Reinhold, seated, Councilmen Norman Kunish, right and Alfred Lindeman, center. They are shown with Plant Superintendent Arthur G. Reinhold.



$10 MILLION REPOWERING OF SCENICRUISER FLEET

Massive Program Starts After Three Years of Test and Evaluation; 375 HP GM 8V-71's with Spicer Four-Speed Transmissions Make Up Power Package for 984 Greyhound Dual-Level Units

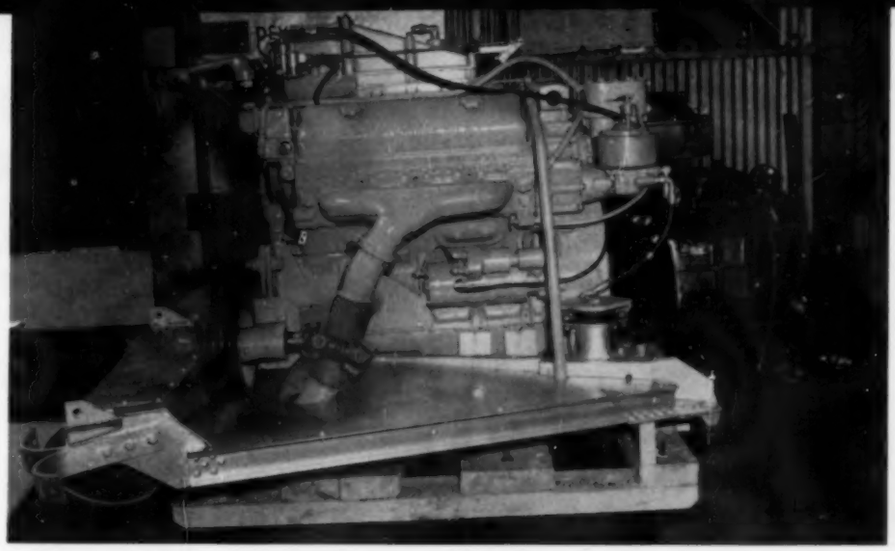
By ROBERT E. SCHULZ

CHICAGO, Ill.—"It's a tremendous project,"—this short statement by J. G. "Joe" Stieber, Director of Maintenance of the Greyhound Corp., keynotes what is probably the largest fleet refurbishing and repowering program ever undertaken. The repowering segment of the program, awarded in competition to Marmon-Herrington Co., Inc. of Indianapolis, totals in excess of $10,000,000 for diesel engines, clutches, transmissions and other drive and power components. An additional $3 million will be spent by Greyhound in refurbishing the 43-passenger buses inside and out.

Involved is the total Scenicruiser fleet numbering 984 units. These buses started entering service in 1954 and have since averaged about a million miles each, or an aggregate of close to one billion miles. "Ordinarily after service like this, we would retire the buses to secondline duty," Stieber pointed out. "Not so, however, with the Scenicruisers! Public appeal is very strong, and in addition their large 40 cu. ft. baggage and cargo capacity is a very important factor in Greyhound's package express program. We knew that the chassis and bodies were good for another million or more miles and consequently the decision was made for a complete modernization and repowering program."

Greyhound started its power package test and evaluation program back in 1958. "It's no secret that we have had our share of problems with the original twin diesel engine installations. The two 4-71's driving into a fluid coupling and transfer case plus the three-speed transmission and two-speed fluid clutch was a complicated system. Yet in '54 there was no single automotive diesel that would do the job. With several new diesel developments in the Scenicruiser horsepower range since that time, we were convinced that we could find a power combination that would eliminate our mechanical problems and which we could treat as any of our other single engine coaches."

Working with Marmon-Herrington and the GMC Truck & Coach Division, seven Scenicruisers entered the testing program. Diesels, both in-line and V-types, turbocharged and naturally aspirated were installed with various types of clutches, trans-



Right hand side of the engine in relation to installed position in the bus. Stainless steel mufflers are visible at lower left. Pulley drive to the right of the mufflers and the unattached universal are for the Freon compressor of the air conditioning system, which will be located on the cradle at this point. Exhaust manifold is specially designed to permit this positioning of compressor. Special air intake housing is at top of the engine, to the left of it portions of the cooling system are visible. Power steering pump, air compressor and alternator are at right hand end of engine. Below this group is Spicer four speed, manual shift transmission.

View of forward end as engine will be installed, showing transmission, power steering pump, compressor and alternator. Both exhaust pipes are visible as are two of the engine mounts. Specially mounted eight bladed, 32 in. diameter fan is driven through a right angle gear in a pillow block. Brackets with drilled holes directly below the blades of the fan and directly to rear of pillow block are for installation of torsional stabilizer to reduce lateral movement of the engine. Electric reversing shift mechanism is atop the transmission.

missions, and axle ratios. The testing grounds were Greyhounds' franchised cross-country runs where miles are amassed quickly and results obtained on the same basis. As an example, Stieber pointed to the Chicago-San Francisco run—a trip of 2,400 miles accomplished in 56 hrs., running time, or, on a round trip basis better than 300,000 miles a year with sustained operation. Equally important in a round trip run like this, 18 different drivers are used, and their reports on equipment operation funnel back promptly. This was the test track and in the three-year program, well in excess of a million miles were logged on the test equipment.

Early this year, the test results were announced with the GM 8V-71 diesel selected on the combined basis of its test performance and adaptability to the existing engine compartment. In addition was the experience of the Greyhound shop and operating personnel with the series 71 engine and the standardization of parts inventory in the various garages and overhaul depots. The 8V-71 engine, introduced by Detroit Diesel in early 1959, is a two-cycle, naturally aspirated 4¼ x 5 engine.

Based on the road tests, this engine will be rated 275 hp at 2200 rpm in 1st, 2nd and 3rd gears. Horsepower will drop off slightly in 4th gear at 1950 rpm. These ratings and speeds may change in the final production installation. As shown in the drawing, the engine will be installed longitudinally with the chassis and tilting is not required. The compact Vee will drive through a Long two-plate dry clutch (the same as used in the new GMC PD-4106 coach) to a modified Spicer 8245B four-speed transmission and the same builder's series 1800 prop shaft. This shaft is one size larger than that previously used and is flanged on both ends. The air suspended Timken rear axles (driving and trailing units) have been retained, but a new differential carrier will be installed to change axle ratio from 4 8/9 to 3.7:1, thus assuring a perfect match with the Spicer transmission.

A seven groove pulley is fitted to the front take-off shaft—four grooves for belt driving the freon compressor for the Scenicruiser's air conditioning system, and three which belt drive a right angle gear box for the radiator fan. The radiator, supplied by Young and using a Schwitzer fan, is located at the rear left side of the coach. Present Scenicruisers with their twin 4-71's have individual radiators with inlet at the rear of the bus. As an added reliability factor, Greyhound will use the new Delco-Remy gear-driven oil-cooled 12 volt generator with full transistorized regulator and high torque totally enclosed starting motor.

According to Stieber, the repowering and refurbishing on the Scenicruisers commenced about October 1 with the work being scheduled in several of their major garages. It is anticipated that three units will be completed a week at each garage location and the entire project completed in 12 to 16 months.

Overall exterior of the modernized Scenicruisers shows new, larger identifying lettering. Rear will change to conform to new powerplant cooling requirements.

OPEN NEW ENGINEERING LAB TO TEST TRANSMISSIONS, TORQUE CONVERTERS

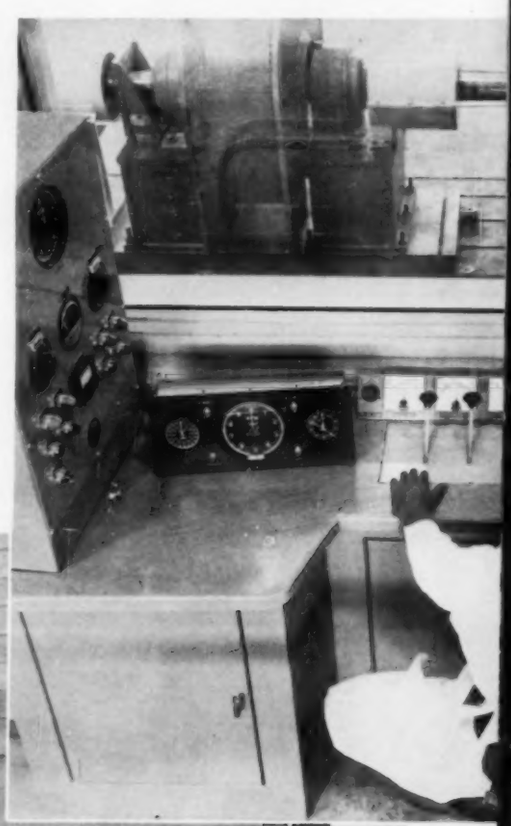
Facility of Clark's Automotive Division Can Simulate Field Conditions to Pre-Test Prototypes, Custom Units and Speed Diagnosis and Correction of Problems

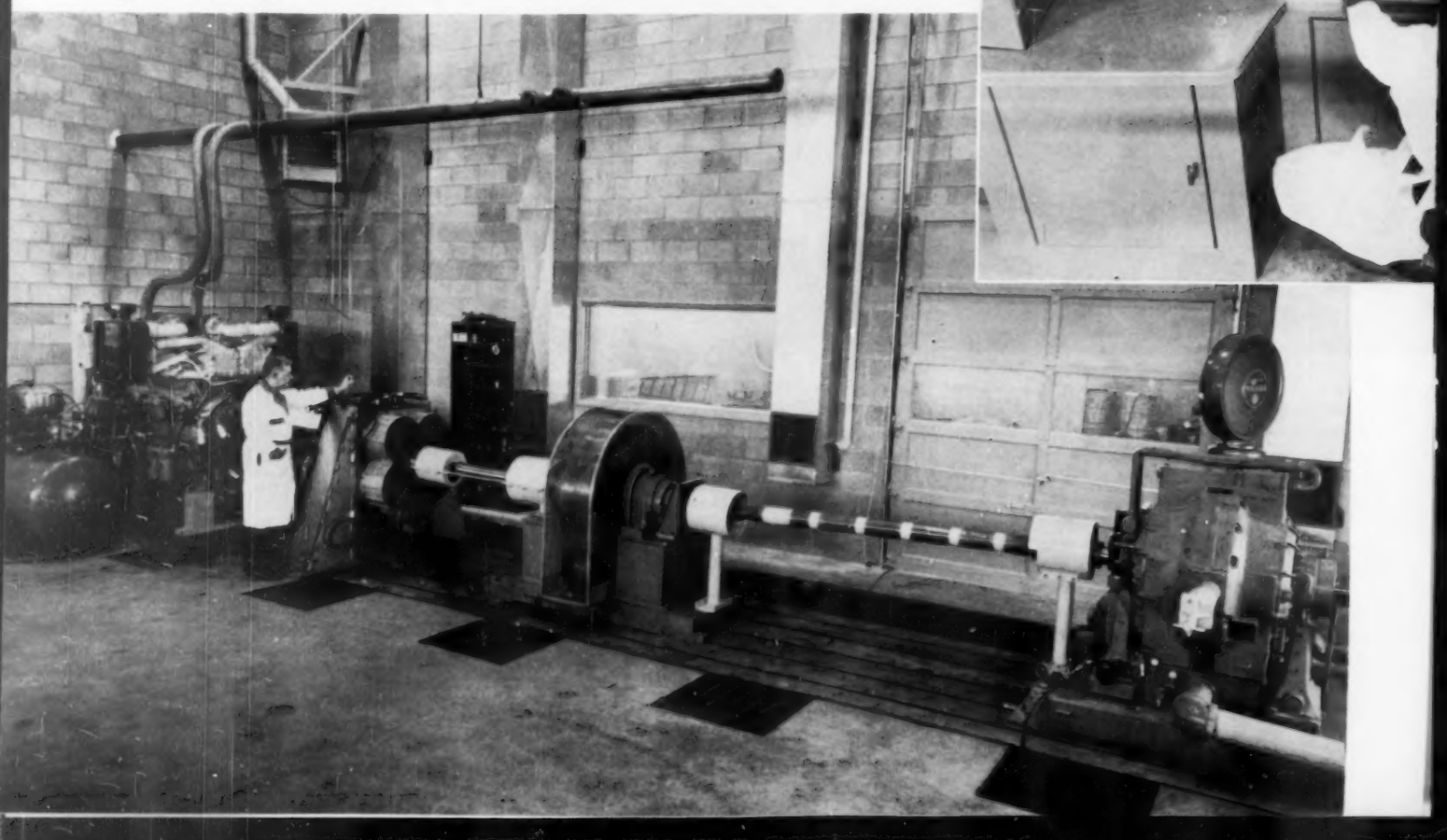
A NEW engineering test laboratory, where field conditions for testing the company's line of mechanical and hydraulic transmissions and torque converters can be simulated, has been opened by the Clark Equipment Company's Automotive Division. The new facility at Jackson, Mich., enables Clark to pre-test prototypes and custom-designed units under controlled conditions, eliminating as much as 75 per cent of the time-consuming field testing previously required. In many cases, Clark said, test results are available within 48 hrs. This permits faster diagnosis and corrections of troubles experienced in customer service. The new lab also helps speed production operations by allowing component testing during manufacturing. This eliminates awaiting field reports before design and manufacturing changes are made.

The new test lab contains 9500 sq. ft. and is divided into two main sections. One contains four test cells, three of which contain electronically controlled dynamometers of 300, 700, and 1250 hp rating. These are used to determine the life expectancy, efficiency, shifting quality, and other performance data on transmission operation. Each dynamometer is mounted on an individually constructed bed plate, spring supported and insulated from the building to eliminate vibration. Control panels are located outside the cells to assure safety of personnel. The fourth cell is equipped with three Allis-Chalmers spinner units with ratings up to 100 hp. These are used to help solve lubrication problems, to test for gear noise level and to evaluate effects of speed.

Dynamometer testing can be conducted in a variety of ways which in each instance would be compatible with the results or information desired. The dynamometer setup is designed for this required flexibility. Thus the bed plates are arranged so that many different power sources can be used. These include conventional diesel engines, turbines, or gasoline engines and electric motors. The torque converter, transmission, or other unit to be tested can be mounted to the bed plate to accept the selected power source. This power is finally absorbed by various means, including electrical absorbtion unit, flywheel, or water brake.

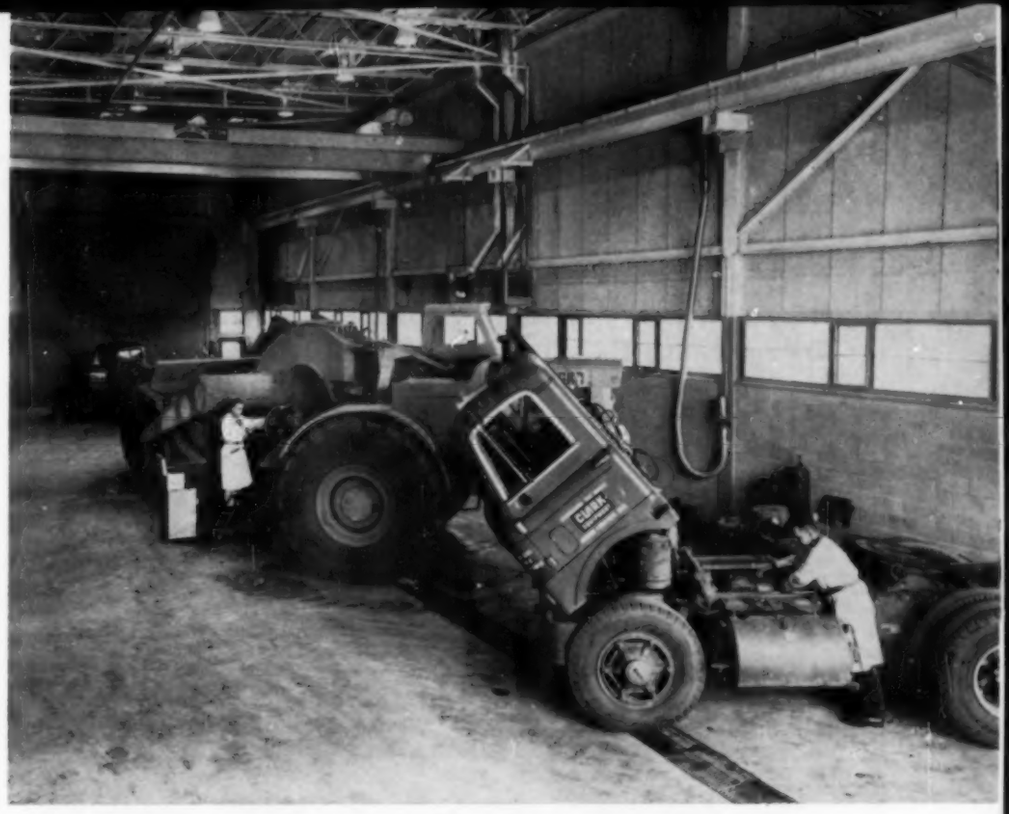
Electronic controls are used to regulate speed and torque load of the dynamometers and high speed spinners. Electric generators and receivers are used to measure speed of the dynamometers and engines. Multi-cam time cyclers are used to control on/off functions when testing individual components or complete power train test setups for automatic cycling. Twenty-four functions, ranging in time from 40 seconds to 18 hours, can be controlled. The dynamometer controls include current control and speed control. The former permits the prime mover to run at various speeds with specific amounts of dynamometer field excitation deter-





mined by the setting of the current control potentiometer. The speed control feature provides regulation that will hold a specific speed in the face of changing output from the prime mover. These two features may be blended so one may take over the other's at a pre-set point. Thus no switch is necessary to change from current to speed control. The operator merely chooses the function he wants (as the test dictates) and adjusts the corresponding potentiometer. The dynamometers accommodate engines ranging from 40 to 1250 hp.

The spinner units are electrical variable speed motors capable of running at infinitely variable speeds to 7000 rpm. They range in size from 10 to 100 hp and are electronically controlled to maintain accurately conditions of speed and time required by each test. The unit under test is driven by the spinner and effects of speed on lubrication of the test unit can be studied. Other

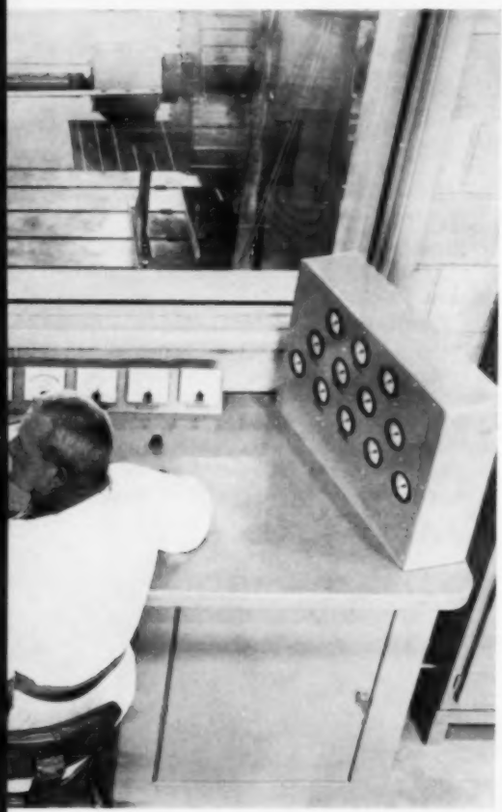


Engineering test lab includes a 4800 sq. ft. section used for teardown and reassembly of highway trucks, construction equipment and other test vehicles. Technician in foreground checks installation in White highway tractor.

observations, such as noise level, oil leaks, internal oil distribution and wear patterns from free running can also be made.

The remainder of the test facility is used for teardown and reassembly of test vehicles, which include highway trucks, construction equipment, fork lift trucks, farm tractors and other vehicles. This garage area is used for installation and removal of test units and test instrumentation in test vehicles. These vehicles are operated on Clark's proving grounds adjacent to the laboratory.

"This laboratory is a tool aimed at keeping product failures in 'our own back yard' where design can be evaluated and deficiencies corrected so the customer is not the proving ground, saddled with the expense of development," said Ernest E. Eaton, Clark's director of engineering. "It also serves an important function in the improvement of the product, particularly in the area of cost reduction where new techniques and new materials can be developed." General design as dictated by the need was determined by the Clark Transmission Division engineering staff. The design was refined into the finalized working draft by Austin Engineering Co., of Chicago. The test laboratory is designed to have 15 full-time employees with consultation and instructional services provided by the full complement of Clark's product engineers.



Lab personnel can check performance of transmission or converter units under test at console which controls, records action of unit on test dynamometer, background. Facility can simulate field conditions for the tests.

This dynamometer, of 1250 hp rating, is one of three at Clark test facility. Dynamometers are arranged so different power sources, including diesel and turbine engines, can be used as power source for test of transmissions, converters.

External view of Clark Equipment Co., engineering test laboratory. Facility contains 9500 sq. ft., adjoins firm's proving grounds at Jackson, Mich.

SPECIALIZED VESSEL FOR FLORIDA-BAHAMA TRADE

M/V *Ituri* and 75th Dixie Dredge Go Into Service Equipped With Caterpillar Power. Craft is "Over the Beach" Unit Designed to Serve Small Island Harbors and Inlets. Hydraulically Powered Cutter Head is Dredge Feature

By ED DENNIS

TWO new specialized marine units, completed in recent months, have gone into service for their owners in the past several months. Both Cat-powered, they are the *M/V Ituri*, an "over-the-beach" freighter operating from Miami to Nassau and the "outer islands" of the Bahamas; and a new Dixie dredge with hydraulic-powered cutter head put into service in Panama.

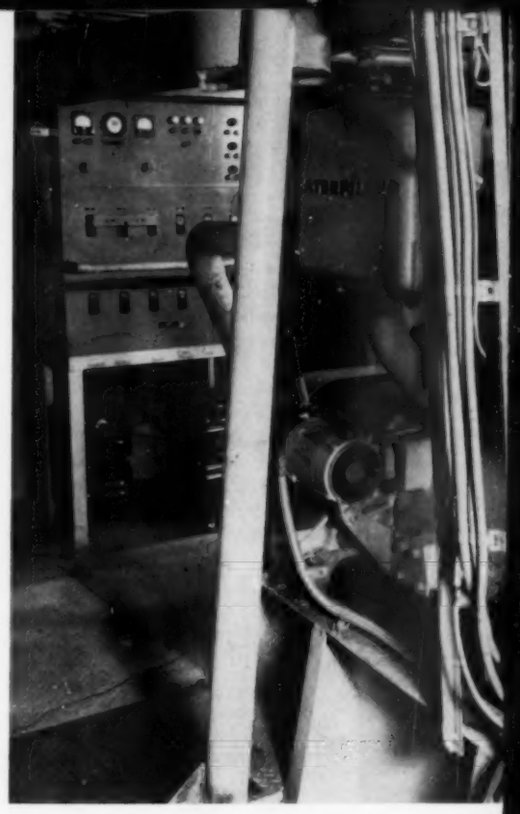
The *Ituri*, used for transporting refrigerated and roll-on, roll-off cargo, is of the Blount Seavan landing craft type with a 14 ft. wide bow ramp and four watertight side-loading portals. The entire main deck cargo area of the 100 ft. vessel is covered and has a continuous, removable hatch running the full length of the vessel. In addition to the main deck cargo area, there are three cargo compartments in the hull.

Draft of the *Ituri* was held to a minimum to facilitate entering small harbors and inlets of the coral reefed cays and island the ship visits. The "outer islands," around Nassau, capital of the British crown colony, consist of some 2700 islands and cays spread over several thousand square miles.

Design of the vessel is an improved development of the type previously worked out by Blount Marine Co., of Warren, R.I., and Capt. Jack Curtis, president of the African Rivers Line, Ltd. She is a sister ship of the *Kasai* built in 1960 by Blount for African Rivers. Both are named for rivers in the new Congo Republic in Africa.

Power for the *Ituri* is supplied by a pair of six cylinder, model D343TA, Caterpillar marine diesel engines each rated 300 cont. hp at 1800 rpm. These compact, lightweight, turbocharged and aftercooled engines have a bore and stroke of 5.4x6.5 in., and piston displacement of 893 cu. in. They each drive a 23 in. pitch x 36 in. diameter Columbian propeller through Cat-built 2:1 ratio reverse-reduction gears.

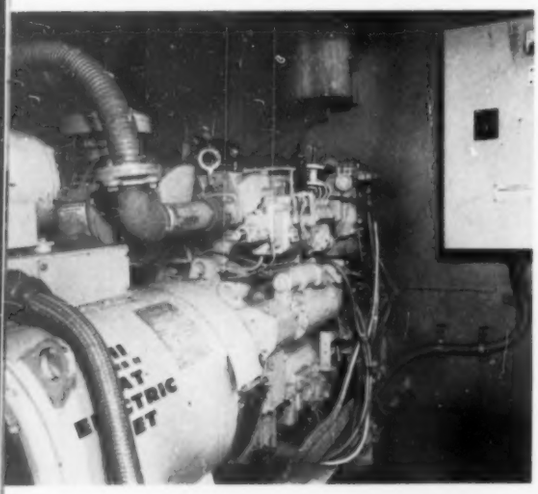
Both main engines have power takeoff clutches to supply power to two 15 kw generators. Fuel oil consumption of the main engines runs 18 gals. per hour for each engine. The *Ituri*'s speed across the Gulf Stream to Nassau is 11 knots loaded and 12 knots light, or about 16 hrs. loaded and 14½ hrs. light between Nassau and Miami.

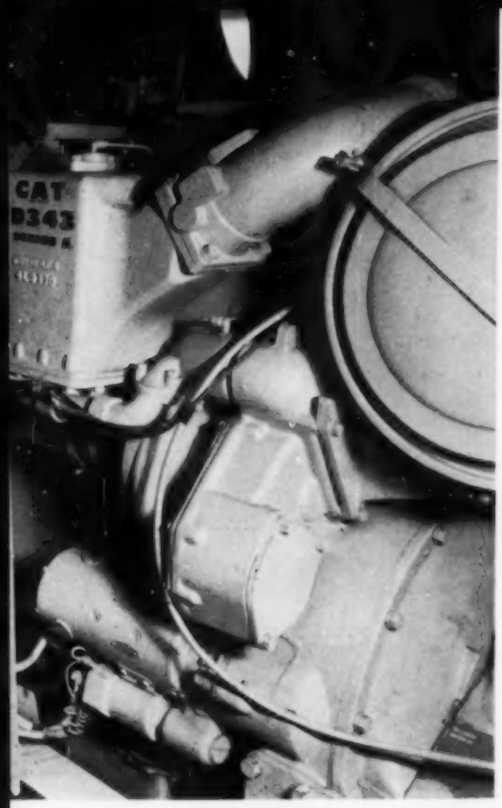


The *Ituri*'s sister ship, the *Kasai*, is also powered by a pair of Caterpillar diesels. These are D342T Cats, turbocharged and rated 220 cont. hp at 1200 rpm. Steve Darlington of Shelley Tractor Co., supervised engineering of the propulsion engines for both vessels. Auxiliary power for the *Ituri* is supplied by a Caterpillar D311H diesel-generator set rated 120/208 volt, 104 amp, 37.5 kva, 30 kw at 1800 rpm.The *Ituri* has a "V" bottom of ⅜ in. welded reinforced steel plate which allows the freighter to make the rough Gulf Stream crossing

The 100 ft. *Ituri* during its trial runs. She is powered by a pair of D343TA Cat diesels, made 13.1 knots. Vessel is a Blount Seavan design with a 14 foot wide bow ramp.

D311, series H, Caterpillar dieselized 120/208 volt, 104 amp, 30 kw generating set is used for auxiliary electric power on the *M/V Ituri*.

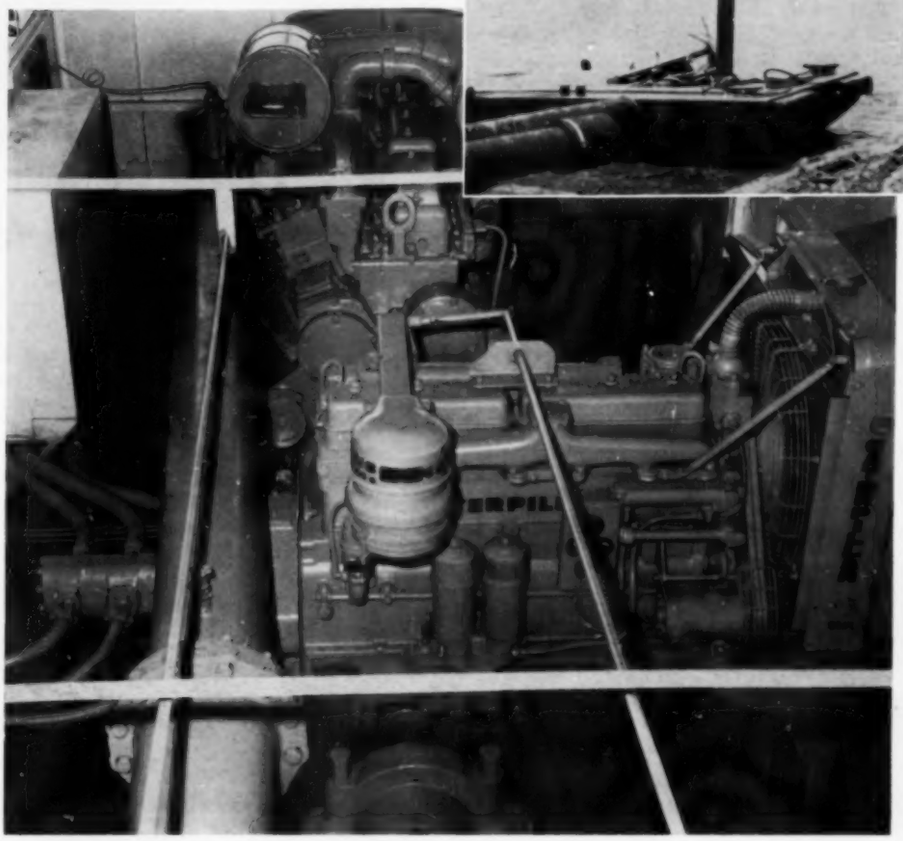




One of the Caterpillar D343 series A turbocharged and aftercooled marine diesel engines, each rated 300 cont. hp at 1800 rpm, installed for main propulsion on the *Ituri*.

A model CD-10-D Dixie dredge in operation at Villa Hernaso, Mexico, is similar to the one that went to Panama.

Caterpillar D318G, 137 hp diesel engine in foreground powers the dredge's hydraulic system and the Caterpillar model D353C turbocharged diesel powers the dredge's 10 inch Pettibone pump via a Cotta transmission, Falk 16 F coupling.



without pounding at normal speed. The superstructure is of $\frac{5}{16}$ in. steel. The pilothouse is aft and is fitted with a Raytheon radiophone, automatic pilot, Bendix fathometer and a Sea Slave audio transceiver or echo sounder.

African Rivers Line also operates the 86 ft. Bahama-built freighter *Spanish Sea Queen* out of Nassau in the interisland trade. Seventy per cent of the island cargo deliveries of the line are of the "over the beach" type.

The new Dixie Dredge is the 75th of the type built by the Service Machinery Co., of South Florida. The Caterpillar-powered portable dredge is in service for Cemento Atlantico, S.A., in a sand and gravel operation in the Republic of Panama. This power packed unit is 32 ft. long, has a beam of 10 ft., and hull depth of 5 ft., and is 10 ft. high overall. The reinforced, stress-resistant, scow type hull is built of $\frac{1}{2}$ in. welded steel plate throughout.

A model D353, series C Caterpillar diesel engine supplies power through a Cotta transmission and a Falk 16F coupling to the 10 in. Pettibone pump. The turbocharged diesel has a bore and stroke of $6\frac{1}{2}$x8 in. and piston displacement of 1473 cu. in. Rating is 290 cont. hp at 1200 rpm or, if necessary, a maximum of 390 hp.

The hydraulic pump which powers the dredge's cutter head power unit plus other hydraulically operated accessories is driven by a model D318, series G Cat diesel engine. This 525 cu. in. unit develops 137 max. hp or 83 cont. hp at 1600 rpm. The dredge relies on the engine's regular 32 volt dc generators for inside and outside lighting during night operations.

Chief among unique design features is that the long drive shaft on the ladder has been eliminated and in its place a hydraulic cutter head unit is mounted near the head of the ladder. This, with its short power shaft to the cutter head, eliminates maintenance problems with misalignment and bearings for the long conventional drive shaft. The extra weight of the hydraulic cutter unit tends to keep the cutter deeper into the material being dug. This dredge can dig to a depth of 60 ft. and convey the material at least a quarter-mile, depending on the size of the pipe and pumping machinery. In some cases it can pump up to two or three miles from the excavation.

ENTERPRISE COMPLETES $4 MILLION ENGINE PLANT

All Engineering and Manufacturing Operations Now Integrated at New Facility in Oakland

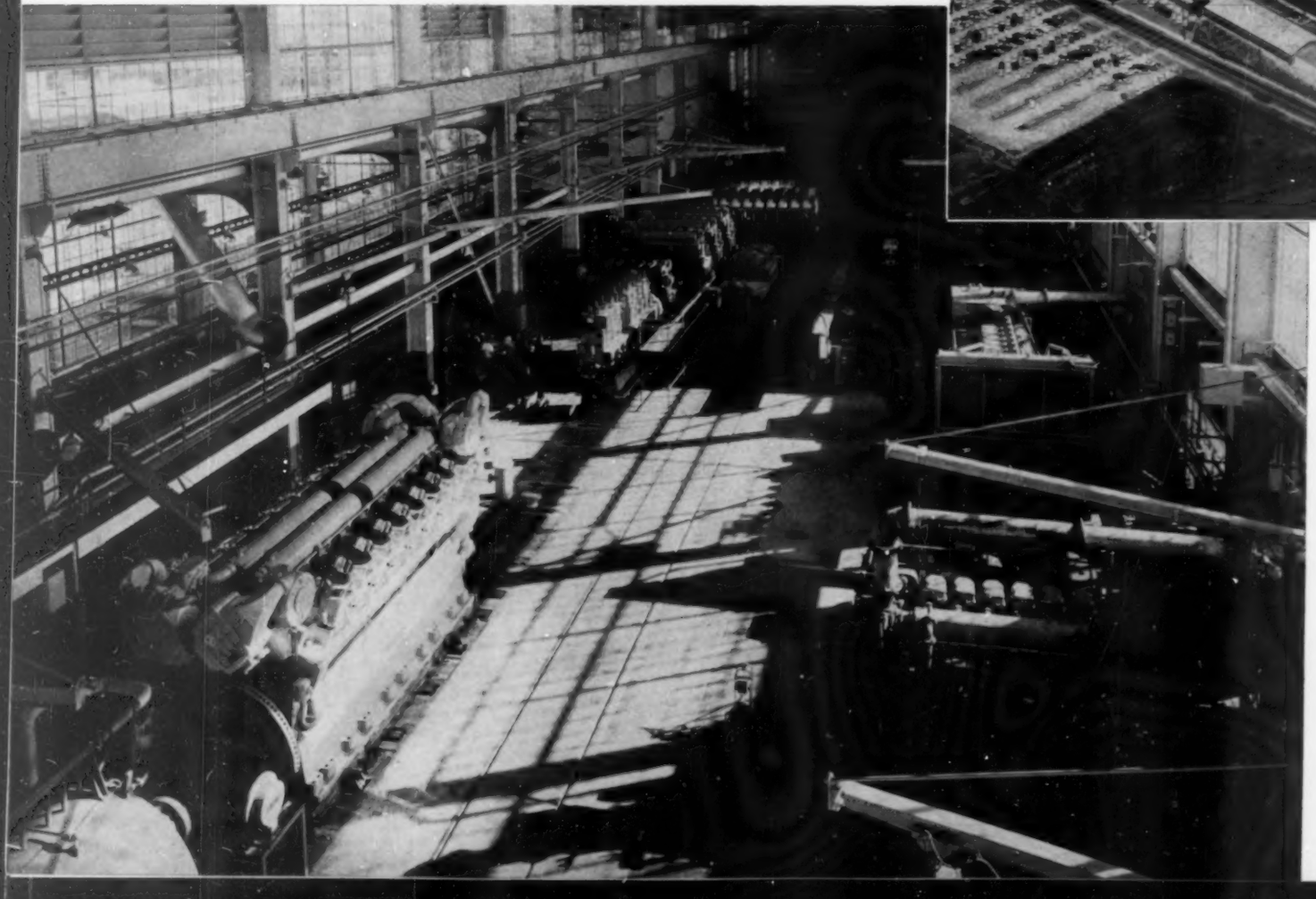
WHAT does it take to build modern, heavy-duty diesel and natural gas engines? A tremendous investment in men, materials and facilities is a short answer, but it doesn't begin to tell the whole story. For a good example of this, let's go out to Oakland, California where the Enterprise Power Division of General Metals Corp. recently completed a new manufacturing facility designed primarily for the production of heavy-duty engines and other Enterprise products.

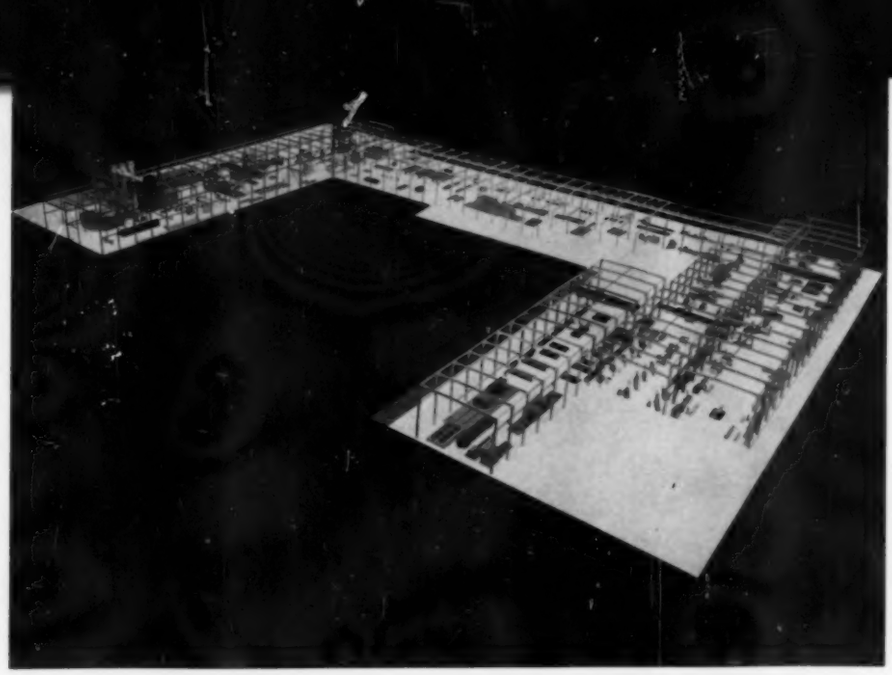
In May of this year the first engine was shipped from the new Oakland plant and at that time John Sheusner, general manager of the Enterprise Power Division stated, "We firmly believe in the future of large engine power and have backed up this belief with a substantial dollar investment. This engine represents the culmination of two and one half years of effort and an expenditure of nearly $4 million in new plant and equipment." Essentially what General Metals did was combine its Oakland steel foundry—one of the most modern in the West—with its engine manufacturing operation formerly located across the Bay in San Francisco. Result—a large, integrated plant with ten acres under roof, and most important from Enterprise's standpoint, raw materials are going in one end and diesel engines are coming out the other.

Besides the efficiency in manufacturing and materials flow, General Metals has achieved some very desirable administrative goals. Its engineering and administrative functions are now under one roof, and the same engineering group now designs the product from the castings up with resulting speed in changes and greater quality control. Commenting further, Sheusner sums up the new plant this way, "It gives us more space, more capacity, much greater efficiency, straight-line materials flow and greatly reduced overhead. We've got everything under one roof—and plenty of room to expand. This means improved delivery, lower cost and a better product . . . because we can control the quality the whole way."

As illustrated, General Metals prepared a one-quarter inch scale model before they built the

View of engine assembly and test bay at Enterprise Power Division plant, Oakland.





¼ in. scale model of Oakland plant. Left wing houses foundry, right wing houses Enterprise Power Division.

Aerial view of General Metals Corporation plant at Oakland.

plant. Everything—machines, fork lift trucks, cranes, pallets, castings, railroad cars—was put into scale to determine aisle width, proper materials flow, machine position and spacing, adequate storage by machines—even rest room locations. Basically, the plant is shaped in the form of a wide-base "U". The iron and steel foundries (222,900 sq. ft.) occupy one leg and most of the base; the Enterprise operations (190,000 sq. ft.) are in the other leg and a separate parts warehouse. As the castings and components are received in the machine department from foundry or warehouse, they go to the inspection section for Magnafluxing, sonic inspection and x-ray—large castings are tested with a million-volt x-ray unit. Castings and forgings then proceed through rough machining to heavy machining or light machining depending on size of the material, then to assembly and test.

Every plant has its own character, distilled from its people, its machines and its environment. This plant was deliberately planned for high worker morale as well as top efficiency. It's big, open and easy on the eyes. The bays are high and the sides almost entirely window. Natural light levels are unusually high for a plant of this type. In fact, the windows on the south and west are tinted to reduce glare and summer heat. "Color-coding" is used throughout the machine department to reduce eye fatigue and promote safety. Infra-red radiant heating is used to maintain an even, draftless temperature that never goes below 65°.

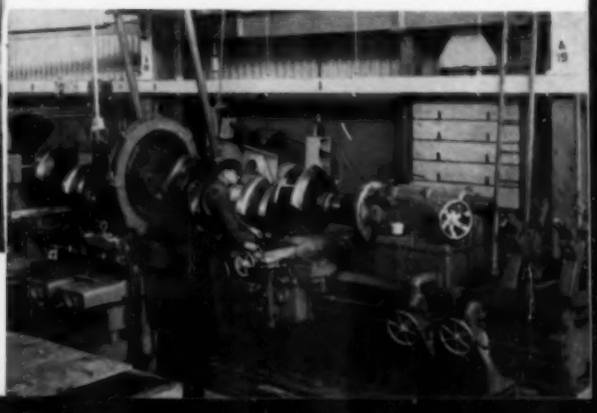
Safety is stressed and good housekeeping has become a conscious habit. Machine Dept. Superintendent Bob Termini calls it, "the cleanest plant I've ever seen." Piping is color shaded to reflect the degree of danger . . . high pressure natural gas pipes are bright red, oxygen piping is less red, diesel fuel pipes are pink. Most jib cranes are equipped with safety hooks. Plant Engineer George Gellatly, pointed out a unique feature of the plant . . . machine and equipment foundations. Consulting engineers specified 8½ ft. of solid concrete isolated by strips of ½" thick Celotex for the foundations of all major machines. In the Grinding Department double foundations—one floating on the other—were specified to completely eliminate vibration.

Another interesting feature of the plant is the test area. Every Enterprise engine is held on test for 16 to 32 hours—through the complete power range under simulated field conditions. Six dynamometers are used, covering a range of 50 hp to 10,000 hp and speeds from 50 to 2000 rpm. Power in the electrical dynamometers is dissipated in grid-type load banks. For the larger horsepower engines, water brakes are used.

The plant will manufacture the complete line of Enterprise engines, ranging from heavy-duty diesels for marine service to diesel, dual-fuel, tri-fuel and spark ignition gas engines for stationary applications. With this new facility Enterprise is taking firm aim at the growing market for large engine power. And according to General Manager Sheusner, the company plans to keep pace with the expanding potential in this market with new engine designs already underway.

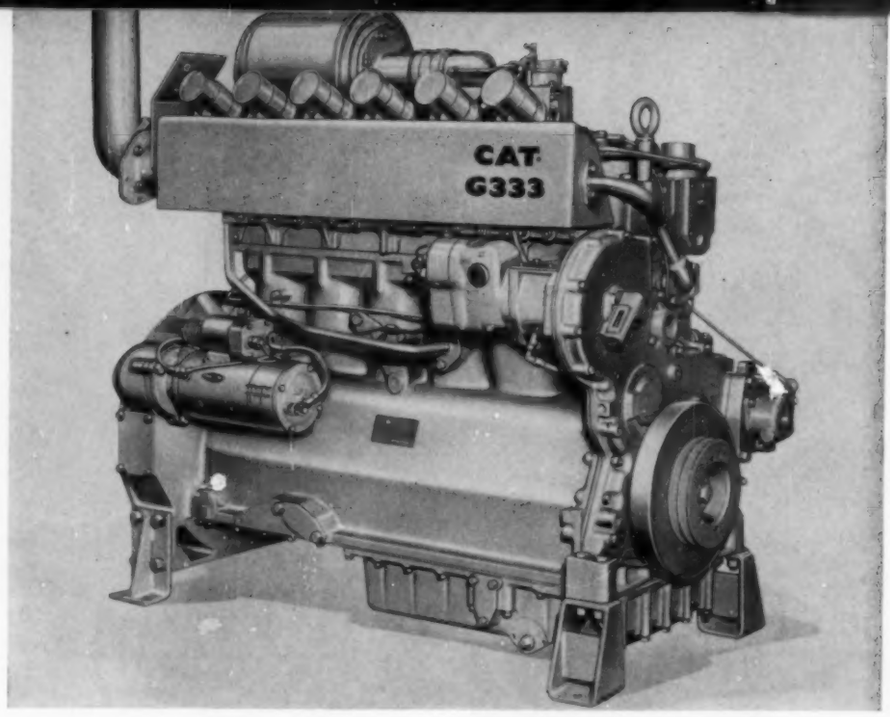
Boring a base for a type G engine on a horizontal boring mill. In the foreground is a crankcase for a type RV, 8-cylinder engine.

Turning connecting rod pin on a crankshaft for a type R engine on a 52 in., 2-carriage lathe.

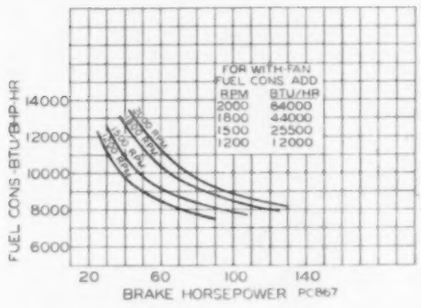


NEW 130 HP CAT NATURAL GAS ENGINE

G333 Units Develop 130 HP at 2000 RPM. Available in 12:1. 8.5:1 Ratio Models



Product view of Caterpillar G333 natural gas engine. Visible are the magnetos and transformer coils for the low tension magneto system, starting motor. Exhaust manifold is water shrouded. On front of gear housing is service meter.



Fuel curve for G333 engine.

Caterpillar has announced the 133 hp, model G333 as its latest addition to the builder's natural gas engine line. The unit develops its 130 hp at 2000 rpm on natural gas when fitted for 12:1 compression ratio. The G333 is also available in an 8.5:1 compression ratio version rated 115 hp at 2000 rpm.

This new engine will be suited for applications requiring a smaller natural gas engine in such applications as air conditioning, irrigation, gas gathering, pumping, low temperature refrigeration and electric power generation.

The new Caterpillar engine uses the D333 diesel as the basis of design and many of the D333 parts are interchangeable with its natural gas counterpart. And, because of the direct conversion from the diesel, the G333 takes full advantage of diesel strength standard. This is a primary factor in Caterpillar's expectation for up to 25,000 hours of operation without overhaul. It also permits taking rated power from the engine on a continuous basis, derating only for altitude and temperature.

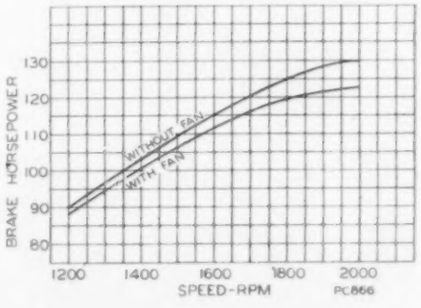
The G333 is a six cylinder, inline engine, naturally aspirated and with a 4.5 in. bore and 5.5 in. stroke. It features a low tension ignition system as standard equipment. This newest unit completes the continuity of Cat's engine line with engines ranging from 115 hp in the 8.5:1 in the G333 to 670 hp in the 10:1 G398TA gas engine. Weight of the standard engine is 1975 lbs.

The G333 gas engine can be equipped with a statically-regulated, statically-excited generator to provide a 75 kw generator set in the higher compression ratio version and 60 kw in the 8.5:1 model.

Physically, the only exterior difference between the D333 diesel and the G333 gas engine are installation of the gas carburetor on the intake manifold, installation of the governor at the front of the timing gear housing and, of course, substitution of the low tension ignition system for the fuel injection system. The governor control can be mounted remotely if preferred by the user. An automatic "economizer" valve on the carburetor extends net end power by a richer mixture at high output, but admits only enough fuel at low output for efficient, economical operation.

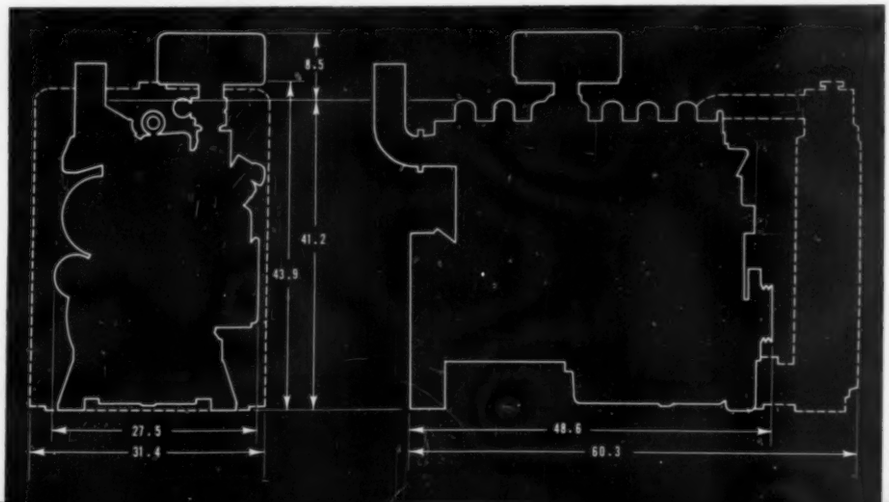
A water shrouded exhaust manifold is standard on the G333 engine. The feature reduces heat in the engine room and helps insure safety of operating personnel. Also standard is either a 12 volt or 24 volt starting system. The engine can also be equipped for hydraulic, air, or gasoline engine starting, according to customer preference.

The higher compression ratio of the G333 is specifically designed to burn processed natural gas at optimum efficiency. The low compression ratio (8.5:1) allows operation on a wide variety of gaseous fuel, including well head gas.



Power curve for G333 engine with 12:1 compression ratio. Engine develops 130 hp at 2000 rpm.

Dimension drawing for G333.



COSTLY DUST PROBLEM SOLVED BY DRILLING COMPANY WITH PUROLATOR 2-STAGE DRY-TYPE AIR FILTERS

First-stage Micronic® element of Purolator 2-stage air filter being replaced by New Jersey Drilling Co. Foreman, Dick Hompesch. One of the nation's biggest drilling outfits, New Jersey Drilling uses Purolator 2-stage filters to protect all its motive equipment.

Four ruined diesels prompt quick switch to Purolator 2-stage dry-type filters with built-in double protection.

"A lot of abrasive silica dust passed right through our old single-element filters and completely ruined four drilling-rig diesels," reports Emil McConnel, New Jersey Drilling Co. VP.

"The extra protection offered by a second filter element sold us on the idea of switching to Purolator 2-stage air filters. Performance has been completely satisfactory. These filters now protect all our motive equipment."

Why Purolator 2-stage filters give complete protection.

Purolator's 2-stage air filters offer extremely high performance because they contain two Micronic® filter elements – each operating independently. If one element should get out of order, the other keeps on removing 99.98% of all contaminates. Harmful abrasives never get into the engine—no matter how dirty the job.

Easy, quick maintenance.

Servicing the 2-stage filter takes only minutes. After housing cover is removed, used element is lifted out and replaced with a new one. First-stage element lasts up to 2,000 hours. Second-stage element should last almost indefinitely.

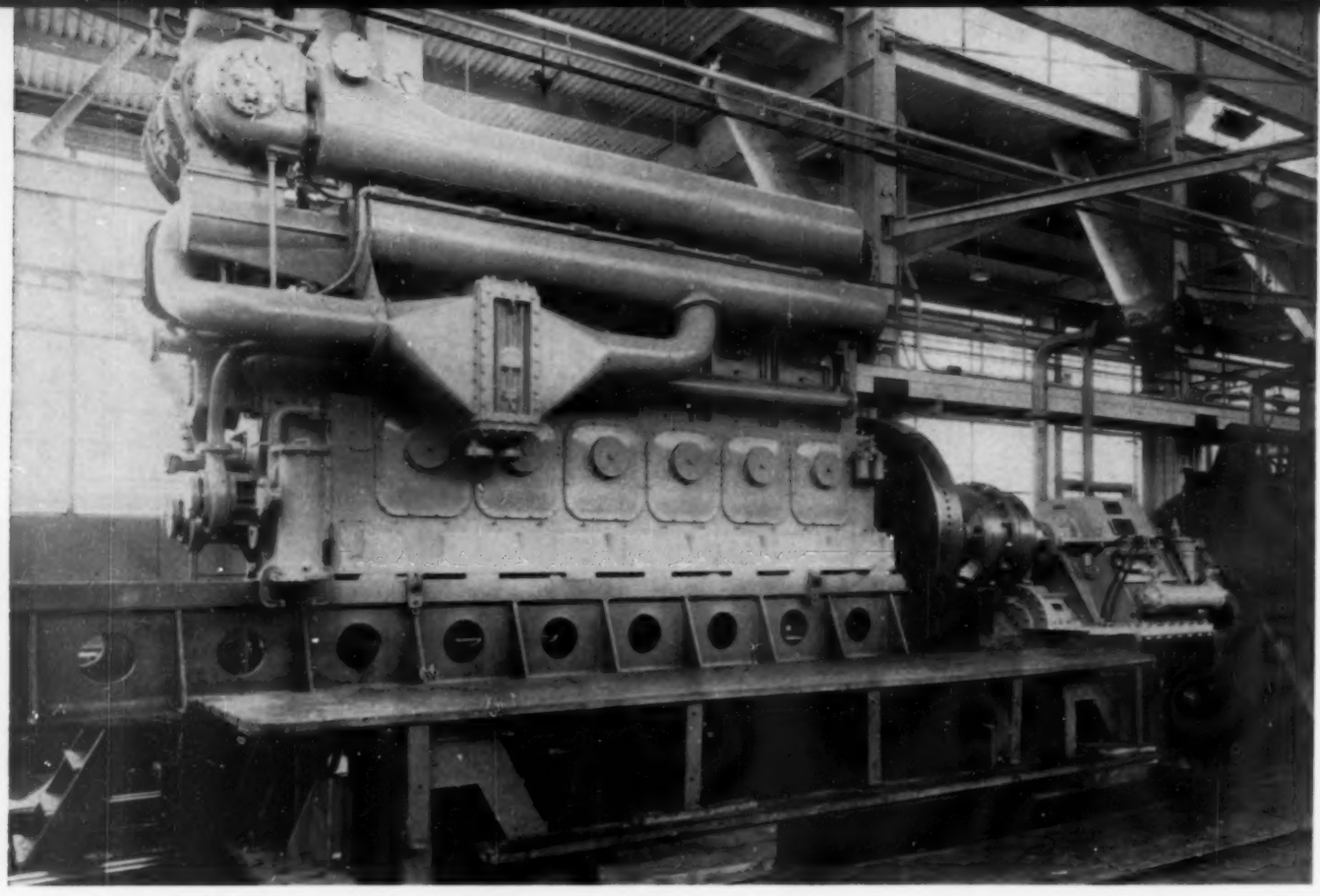
For complete details on the 2-stage, dry-type air filter, write: Purolator Products, Inc., Dept. 7137, Rahway, N. J.

Filtration For Every Known Fluid

PUROLATOR

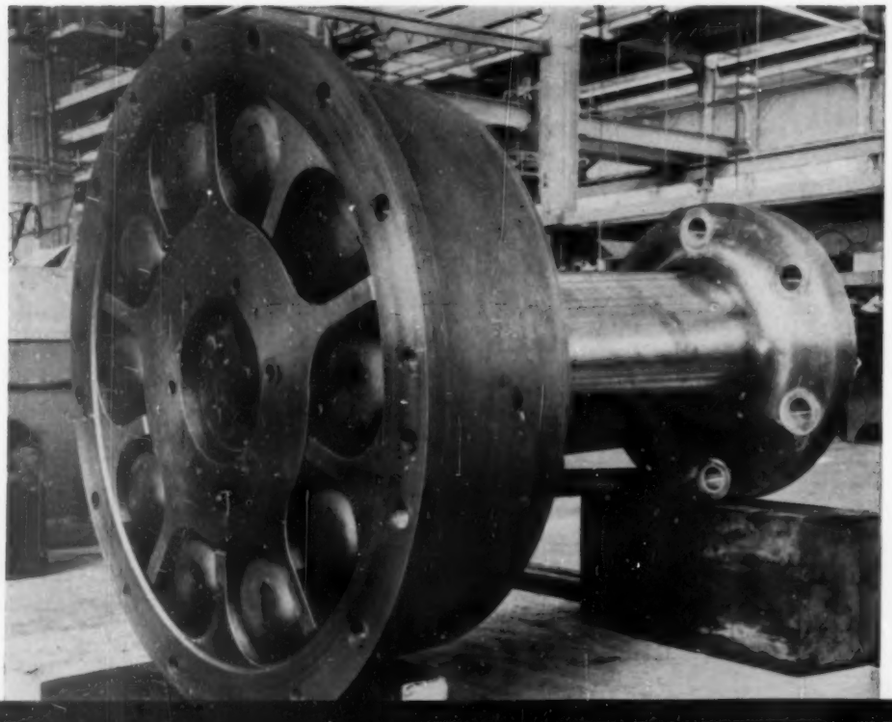
PRODUCTS, INC.

RAHWAY, NEW JERSEY AND TORONTO, CANADA



TANDEM RUBBER COUPLINGS FOR TUGBOAT DRIVE

Two New 1900 HP Diesel Vessels Are Designed for High Degree of Maneuverability for ARAMCO Service in Persian Gulf



BEFORE the end of the year, Arabian American Oil Company will be placing two new 1900 hp tugboats in service in the oil-rich Persian Gulf. These vessels, 110 ft. in length, are presently being completed on the ways of a ship-building firm at Haarlem, Holland; however, most of the propulsion equipment—diesels, couplings and reduction gears—were built in the States. When they enter service, the two tugs will be among the most powerful to operate in this area and design has also stressed a great degree of maneuverability.

The American built propulsion components were recently shipped from the Oakland, Calif., plant of the Enterprise Power Division of General Metals

Portion of one of the Holset resilient couplings showing the rubber blocks through which power is transmitted. This picture was taken before the assembly of the propulsion equipment for the two large Arabian American Oil Co. tugs.

Propulsion equipment for Persian Gulf tug on test stand at Enterprise Power Division at Oakland, Calif. The 1900 hp Enterprise diesel engine's power is transmitted to the Western marine reduction gear through a tandem Holset resilient coupling (center) in which rubber blocks curb torsional vibration. Holset coupling was manufactured by Koppers.

Corp. Each of the two engine sets included an Enterprise model R, four-cycle, six-cylinder, turbocharged diesel of 17 x 21 in. bore and stroke and rated 1900 hp at 375 rpm; a Koppers-built rubber block resilient Holset coupling; and a Western Gear Co. SeaMaster reduction gear with a 3.25:1 ratio. These gears are equipped with sleeve-type journal bearings, Kingsbury thrust bearings and heat-treated double-helical gearing and were especially designed to meet the requirements of the 10 ft., 6 in. diameter A. M. Liaaen stainless steel controllable pitch propellers used.

Rubber Block Coupling

Design emphasis, as mentioned, was on maneuverability and it's expected that the new ARAMCO tugs will hit high standards in this area with both the hull design and propulsion system tailored to achieve these aims. Usually, in reduction-geared tugs, the idling speed is comparitively high. However, these tugs are required to operate at very low idling speeds in order to hold the huge tankers in place or ease them gently into tight berths. The only way these idling speeds could be attained was to include a coupling with a great deal of torsional flexibility. The tandem Holset resilient couplings, built by the Metal Products Division of Koppers Company, Inc. under licensing agreement with L. P. Croset, Esq. and Holset Mfg. Co., Ltd., permit operation of the engines through their entire range of power and speed, without regard to inherent critical speed conditions. By using the tandem rubber couplings, the critical point of vibration is shifted down below idling speed and below the point where gears will rattle.

The Holset couplings are designed with an outer sleeve that has blades extending inward, and an inner hub with blades extending outward. Between the blades are spaces into which are compressed 20 cylindrical blocks of specially-formulated rubber, each $6\frac{1}{4}$ in. diameter x $10\frac{7}{16}$ in. long. When the inner member turns, its blades press on the rubber blocks which tend to assume the dimensions and shape of the cavities in which they work. Alternate rubber blocks flex, exerting pressure on the blades of the outer member. Only under conditions of extreme overload do the rubber blocks completely fill the cavities. In this manner, the rubber blocks dampen the torsional vibration and result in smooth operation in either direction. No lubrication is necessary and the couplings are maintenance-free. They are made of ductile iron, each weighs 5,030 lbs. and attached to an 8 in. shaft. Before the decision was made to use the Holset coupling, Trescott S. White, General Metals Corp. torsional engineer, made mass-elastic studies of 13 different machinery arrangements, determining in each case the magnitude and frequency of peak torques.

GAS TURBINE PROGRESS

A MONTHLY SUPPLEMENT TO DIESEL AND GAS ENGINE PROGRESS REPORTING ON NEW DEVELOPMENTS AND APPLICATIONS IN THE TURBINE POWER FIELD

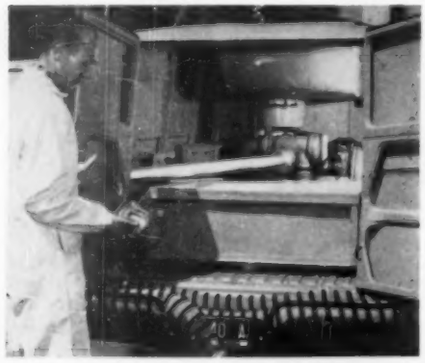
Turbine for Propane Pumping

Mid-America Pipeline Company, Tulsa, Okla., has ordered a Solar Saturn T-1000 gas turbine engine to be used in its propane pumping operations, it was announced by O. M. Sievert, Solar manager of turbomachinery sales. Mid-America will use the variable speed version of the Saturn turbine coupled to a centrifugal pump to increase capacity on the west leg of the pipeline. The unit will be skid-mounted and will be located at the company's booster station near Whiting, Iowa. It will be used on a continuous duty basis. In this application, the turbine will operate on propane fuel taken from the pipeline. It will also be capable of using any other available fuel, such as kerosene, gasoline, diesel oil or butane.

Boeing Turbo-Starter

Boeing has put into production a new version of its Turbo-Starter ground support unit for jet air liners which incorporates a new model of their gas turbine-driven compressor. The compressor, rated at 205 air horsepower, is mounted in the rear of a panel truck and supplies high flow low pressure air for the job of starting jet engines. The unit is also used to check out jetliners' extensive pneumatic systems and motor jet engines during maintenance checks. The new model 502-12B compressor is similar to the earlier compressor but incorporates improved design features. These include turbine wheels with mechanically attached blades, a newly designed nozzle box and higher strength high temperature materials in engine "hot parts." The improvements in the Boeing turbine compressor were designed to increase the life of the unit and reduce maintenance costs. The new compressor recently successfully completed seven weeks of grueling around-the-clock operation in a 5,000 start and 500 hour Air Force endurance test.

Gas turbine-driven compressor supplies high-flow, low-pressure air for starting engines on jet air liners. Mechanic holds air delivery hose, and duct in center of truck runs from air flow controller on compressor to hose. Turbine is exhausted through roof of panel truck.



Turbine Saves Time, Money

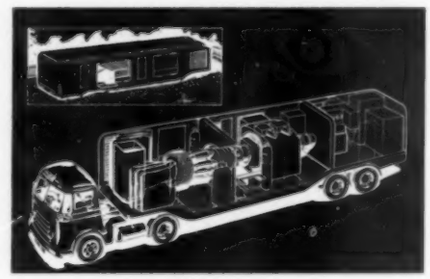
Savings in dollars and time are the result of a new fuel transfer system cleaning procedure successfully tried by the U. S. Navy. Following normal system and fueling pit cleaning using a pig and fresh water flushing, the Navy recently tried a new drying method using a small gas turbine engine built by Garrett's AiResearch Manufacturing Division. The unit, which normally supplies compressed air to start Navy jet aircraft engines, dried 1,500-ft. of 14 in. system pipe in nine hours time. Savings included the alcohol formerly used in this drying operation. The experiment took place recently at the U. S. Naval Air Station, Cecil Field, Fla. Similar uses for its turbines are also being found in oil fields cleaning and sandblasting underground pipeline, according to AiResearch.

Two Turbine Generating Sets Ordered

Delaware Power & Light Co. has announced plans to install two gas turbine generating units at an estimated cost of $2,250,000. In doing so, the company deferred plans to build a fourth 150,000 kw generating unit at its Edge Moor, Del. power station. One of the new turbine sets was ordered from Pratt & Whitney Aircraft Co., a division of United Aircraft Co. It will be rated 13,500 kw for peak load operation and will be installed at the utility's Edge Moor plant. The second turbine set is being supplied by General Electric and is that company's 11,250 kw portable unit. It will be installed at DP&L's Wilmington substation. Both units are expected to be ready for service by November 1, 1962.

3 MW Turbo-Generator Package

A transportable 3 megawatt "pocket power station on wheels," plans for which were announced earlier this year by Bristol Siddeley—is being produced at the company's Ansty, near Coventry, England, plant. The complete generating unit—gas turbine power plant, generator and controls—



is housed in a single 3 mw "power package," which can be carried on a single semi-trailer, by rail on a flat car, or lowered on to any level firm site for stationary use without specially prepared foundations or buildings. Previously, separate units were used for generation and control. This compact, self contained turbo-generator is powered by an industrial version of the Bristol Siddeley Proteus gas turbine engine. Bristol Siddeley 3 mw remote-controlled power stations have been in service for two years already in the United Kingdom with the South Western Electricity Board. The "power package" is completely self-contained, the only requirement being a fuel supply. A notable feature is the range of fuels that can be used with the industrial Proteus; fuel systems are available for kerosene, diesel fuel and natural gas. For mobile use, the equipment's aluminum body, divided into three compartments, on its heavy-duty welded chassis, is easily transportable by tractor and eight-wheeled semi-trailer. If the "power package" is to remain on a permanent or semi-permanent site, there is no need for foundations as the chassis is rigid and provided with six levelling jacks. Air intake and exhaust systems are silenced to a noise level acceptable for use in most residential areas.

Gasifier turbine nozzle support, transition liner support, and gasifier turbine casing (left to right), used in the Allison GMT-305 Whirlfire regenerative gas turbine engine. Note complexity of center casting and fine-finish precision machining of all castings.

HIGH ALLOY CASTINGS EASE TURBINE METAL PROBLEMS

Type CF-8C Alloy Utilized in Allison Gas Turbine Is Formulated to Resist Corrosion in "Hot Areas". Provide Good Machinability and Weldability For Economic Production

TO solve the problem of high temperature, corrosive combustion products, and high stress inherent in vehicular gas turbine engines, engineers of GM's Allison Division have made liberal use of high alloy castings in the design of the GMT-305 Whirlfire regenerative gas turbine engine. The GMT-305 is a multi-fuel engine which develops 225 rated horsepower. Such a high concentration of power in a small, lightweight unit means every working part is highly stressed, operating temperatures in the combustion zone are high (1600-1700 F), and the products of combustion are corrosive.

To handle this combination of extreme operating requirements in such a highly concentrated weight-size "package", castings made of SAE 60347 alloy (Alloy Casting Institute designation CF-8C) are used for six important components in the "hot area" of the Allison engine. These include the transition liner support, gasifier turbine casing, engine bulkhead, turbine nozzle housing and support, and upper and lower bulkhead extension. The parts range in weight from 4¼ to 54½ lbs.

The operating cycle and design principles peculiar to the gas turbine make maximum demands on the materials of construction. One of the most critical mechanical requirements of this particular application is that the material have high creep strength. For CF-8C alloy the limiting creep stress (for a 0.0001%/hr. creep rate) is about 18,000 psi at 1200 F—well above the maximum requirement. Long time stress corrosion is another problem that is further aggravated by the multi-fuel versatility of the engine. With a wide divergence of chemical elements present in the several applicable fuels, the corrosive products of combustion vary over a broad range.

Type CF-8C is an iron-base, columbium-stabilized, chromium-nickel alloy especially formulated to resist corrosion in services involving long exposure to elevated temperatures. Chemical composition of the alloy is as follows: C 0.08 max., Mn 1.50 max., Si 2.00 max., Cr 18-21, Ni 9-12, Cb 8 x C min - 1.0 max.

According to Allison engineers and metallurgists, the most important properties from the manufacturing standpoint were good castability, machinability and weldability. From the functional point of view they were faced with considerations of: (a) warpage due to heat and pressure differentials, (b) creep stress limit because of the high temperatures under which the metal operates, and (c) corrosion resistance. Combining all these requirements with the economics of production costs tipped the decision in favor of CF-8C castings.

One of the hottest parts of the engine is the bulkhead, which operates at a metal temperature of 1300 F. A partition wall that separates and seals the gasifier section from the power turbine section, the bulkhead is subjected to the highest heat. It also suffers most from distortion caused by the pressure differential of two atmospheres between one side of the wall and the other, and from warpage tendencies created by heat and pressure. Pressure on the gasifier side of the bulkhead is 3½ atmospheres, immediately dropping to 1½ atmospheres on the power side. The same heat-pressure condition causes flexing of the bulkhead wall which, together with the structural stresses induced by warpage, builds up a further consideration of the fatigue limits of the metal.

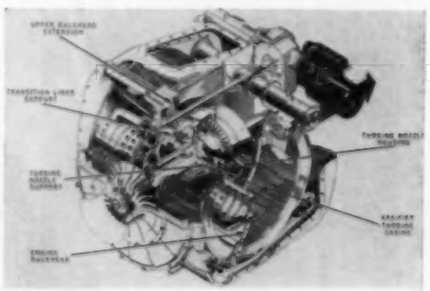
Formerly fabricated by welding many small pieces, the engine bulkhead was redesigned as only three castings of heat and corrosion resisting CF-8C alloy.

As a result of prototype testing, drastic design changes were made in the bulkhead assembly. Formerly, upwards of 20 separate pieces were welded to make a high cost assembly. Evidences of rapid intergranular corrosion hastened the decision to redesign for casting, and to use a corrosion resistant alloy. The result is an assembly composed of only three CF-8C castings. The bulkhead casting is a complex cylindrical segment that requires close tolerance machining to provide mating or matching surfaces. The box-like upper and lower bulkhead extension castings also require considerable precision machining.

The gasifier turbine casing operates in close proximity to hot combustion gases at a metal temperature of 1300 F. For economic life under these conditions, type CF-8C alloy provides the necessary hot strength and corrosion resistance. Although the casting is a simple ring shape, a large portion of it must be machined to match and fit other castings and components.

The transition liner support on the gasifier side of the bulkhead is in a slightly cooler zone although its operating temperature of 1200 F makes high temperature demands on the metal. The casting is complex as well as one of the heavier ones (13¼ lb. finished weight). Precision machining throughout again emphasizes the importance of good machinability of turbine castings.

While the gasifier nozzle support operates at the relatively low metal temperature of only 600 F, there remains the problem of long exposure to temperatures that are consistently higher than "average". The 600 F metal temperature appears low only in comparison with higher ones so prevalent in the engine. This casting is one of the simplest (a ¾-in. thick disc) and one of the lightest parts (4.3 lb. finished). However, its functional use calls for high hot strength and resistance to the ever-present hot, corrosive gases.



Cut-away of the Allison GMT-305 Whirlfire gas turbine engine shows the vital components that are cast in CF-8C columbium-containing stainless alloy.

Test Pace Quickens for . . .

CHRYSLER'S CR2A AUTOMOTIVE GAS TURBINE

By G. J. HUEBNER, JR.*

SINCE the ASME Gas Turbine Meeting in Washington, D. C., interest has continued to mount in the Chrysler 140 hp model CR2A automotive regenerative gas turbine engine. We now have three vehicles so powered—a 2½ ton Dodge truck; a 1960 Plymouth passenger car; and our new experimental car, the Turboflite. The latter, in fact, was shown at the Paris Auto Show in October of this year and created a great amount of interest. From these applications plus continuous laboratory dynamometer testing, we are compiling a tremendous amount of operating experience which thus far confirms our original design goals on the CR2A. To date we have a combined total of 8500 operating hours and this should increase substantially in the months ahead.

To briefly review our development, the first turbine powered passenger car we built was designed primarily as a laboratory tool to check the performance of various components placed together in an engine, and to help determine if a *small turbine* based on the regenerative principle would be practical in an automobile. This unit was demonstrated in a transcontinental run from New York to Los Angeles in March, 1956 using a standard production model Plymouth as the turbine-powered vehicle. Good fuel economy was achieved, although this component test engine was not in any sense a developed power plant. A second engine design in the 200 hp range was far more successful than the first from every standpoint. Fuel economy was markedly improved, acceleration time for the gas generator was reduced 60%, endurance was increased substantially, and again it proved an excellent development tool. The engine was installed in a standard Plymouth, and during a 576 mile highway cruise in December 1958, achieved an economy of 19.4 mpg on various types of fuel, with high level performance. Since then the CR2A has been developed which is adapted to mass production methods and around which our development work is now proceeding.

Key to the CR2A's performance, comparable in importance to the application of the Chrysler regenerator principle, is a variable second-stage nozzle mechanism, see illustration. This device allows continuous automatic variation of the nozzle blades with gas generator and vehicle speed, so that the gas flow is directed to the power turbine wheel blades at an angle of attack optimum over the entire operating range for the achievement of economy, acceleration, or braking. Varying the second-stage nozzle blades as a function of gas generator speed allows turbine inlet temperature to be sustained near the design point value at part load. This increases the thermodynamic cycle efficiency and results in very acceptable fuel economy over the operating range of the engine. Opening the nozzles permits a lower gas generator idle speed and fuel flow at a given regenerator temperature limit and makes it possible to obtain low idle fuel flow. Opening the nozzles during gas generator acceleration increases work output in the first-stage turbine with good accleration and starting conditions. Reversing the nozzles provides engine braking. Braking torque is appreciable at high power turbine speeds, and a small reverse torque can actually be obtained with the power turbine stalled.

The CR2A power plant is a multifuel regenerative gas turbine engine designed as an integrated package developed for automotive, marine, and industrial applications with the objective of manufacturing it at a cost competitive with that of comparable piston engines in comparable production volume. Central theme adopted for its design has been one of practicality, along with performance and ruggedness. Maximum gas temperatures and the limitations of stresses have been selected to assure reliability, and yet allow the engine to have a performance consistent with the most modern practice.

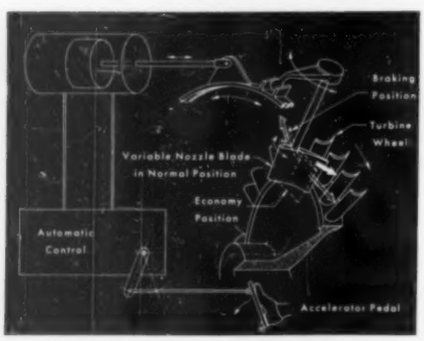
The basic engine could be enclosed in a space approximately 27 in. long, 27 in. wide, and 25 in. high. However, for the existing automotive version of the engine, these dimensions have to be extended locally for such elements as the burner cap, the reduction gear, and the accessory package, until the maximum space required is approximately 36 in. long, 35 in. wide, and 27 in. high. Weight of the engine, including reduction gearing and starter-generator, has been kept under 450 lbs.

Air enters the compressor at a flow rate of 2.2 lbs/sec, at the lowest temperature and pressure in the system, and is compressed at a ratio of 4:1. This air is discharged from the diffuser into a collector which directs it to the upper surface of the regenerator where it passes down through the front half of the core, picking up heat from the corrugated metal matrix. Heated air is then passed through the burner where fuel is burned to bring the temperature up to 1700° F. The hot gas expands through both turbine stages and is exhausted up through the rear half of the regenerator core, giving up heat to the matrix. The regenerator core is rotated mechanically to transfer the heat recovered from the exhaust gas to the compressor discharge. This process allows considerable fuel saving and reduces the exhaust gas temperature markedly.

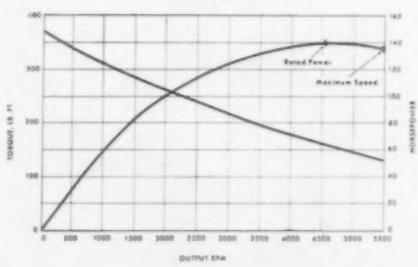
Basic structure is a fabricated steel housing which supports the major component assemblies and provides the connected flow passages. Housing is insulated internally and cooled by ambient air,

Executive Engineer—Research, Chrysler Corp., Engineering Division, Highland Park, Mich.

Variable nozzle system used on CR2A gas turbine engine.



Torque and horsepower performance curves.



Here author George J. Huebner, Jr., looks over CR2A, 140 hp gas turbine installed in Plymouth passenger car.

the housing, is co-axial with the gas generator turbine but is not connected mechanically to it. Its rated output is 140 hp at 39,000 rpm with a maximum permissible speed of 45,730 rpm. Turbine speed is reduced by a single stage helical reduction gear of 8.53:1 ratio resulting in a rated output speed of 4570 rpm and a maximum speed of 5360 rpm. The disk type rotary regenerator is mounted in a cylindrical chamber in the top of the housing for easy accessibility. The regenerator core and seals are assembled into the housing and are enclosed by the regenerator cover. The seals divide the regenerator core into two flow passages, namely, the front half at (high) compressor outlet pressure and the rear half at (low) turbine exhaust pressure.

The single can-type burner, easily accessible, is located at an angle to the side of the housing and is provided with a fuel nozzle and spark plug. Accessories are on the front of the gas generator and driven from the rotor by a simple gear train. A vertical shaft connected to a gear box in the regenerator cover rotates the regenerator core through a pinion and large ring gear, with the required over-all reduction ratio of 2.800:1.

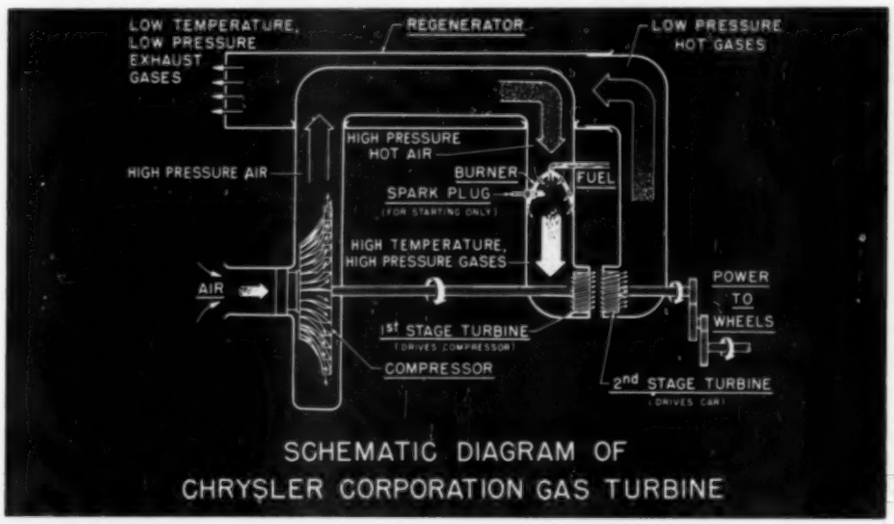
Fuel system incorporates a gas generator speed governor and a fuel scheduling control for acceleration, which are integrated with a gear type fuel pump in one housing to minimize plumbing. This assembly, as well as the fuel nozzle air pump and the lubrication pump, are driven from one accessory drive pad. The starter-generator is geared directly to the gas generator rotor and operates at a maximum of 20,000 rpm. For automobile applications a 12-volt system is used, and burner ignition is provided by a high-voltage buzzer coil and spark gap igniter plug.

The CR2A engine is designed to deliver 140 hp under ambient temperature and pressure conditions of 85° F and 29.92" Hg—with the external intake losses not exceeding .02 psi, the external exhaust losses not exceeding .22 psi above ambient, and the loading on the accessory drives not exceeding 2 hp. The torque and power characteristics of the engine are shown in illustrated curve. Note the power available in the medium and low speed ranges which should simplify transmission requirements. Maximum torque occurs at the stalled condition and is twice as great as the torque available at the rated speed, making it impossible to stall the engine under any load condition since an increase in torque requirement merely causes the engine to slow down. The brake specific fuel consumption at rated power is approximately 0.51 lb/hp/hr. and increases very slowly as the power is reduced according to the road load requirements of the vehicle. Power characteristics are based on a minimum installed compressor efficiency of 80%. First-stage and second-stage turbines have efficiencies of 87% and 84% as installed in the engine.

As the CR2A gas turbine has now reached a stage of development where it may become feasible to offer it for sale to selected buyers, Chrysler is considering making a limited number of these power plants available on a negotiated basis to potential users for study and evaluation in experimental applications.

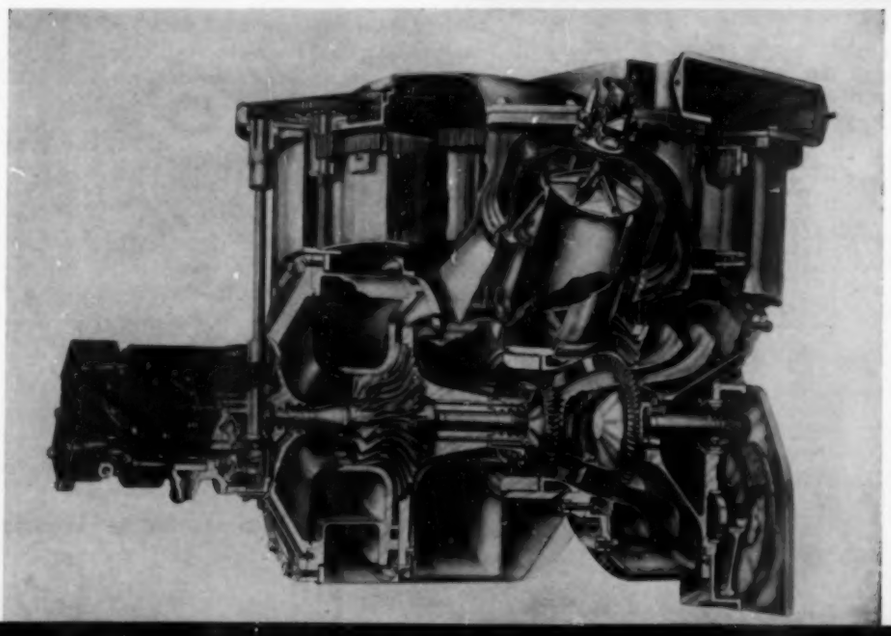
as well as compressor outlet air. Heat insulation also acts as sound insulation, while the regenerator core serves as an effective muffler for the exhaust gases. An intake filter silencer is provided in front of the compressor. The gas generator assembly is installed in the front part of the housing and consists of a radial flow compressor and a first-stage axial flow turbine which drives the compressor impeller and the accessories. This rotor assembly operates at a maximum speed of 44,610 rpm with a turbine inlet temperature of 1700° F at rated power on 85° F day.

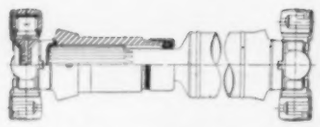
Second-stage axial flow power turbine, preceded by variable nozzles and installed in the rear section of



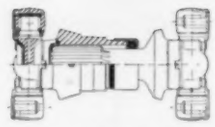
SCHEMATIC DIAGRAM OF CHRYSLER CORPORATION GAS TURBINE

Cutaway of the Chrysler turbine showing regenerator, combustion chamber, air compressor and first and second stage turbine.

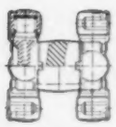




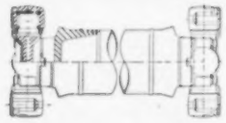
Type "TS"—with tube and slip



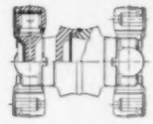
Type "CS"—with slip and without tube —close coupled



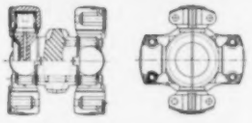
Type "CP"—with coupling plate and without slip—close coupled



Type "T"—with tube and without slip



Type "CY"—without tube and slip—close coupled



Type "CP7"—with coupling plate and without slip—extra close coupled

NEW TWIN DISC POWER TRANSMISSION EQUIPMENT GWB

UNIVERSAL JOINTS

Torque capacities from 4,250 to 12,700 lbs.-ft.

Through a license agreement with GWB of Germany, Europe's largest manufacturer of heavy-duty universal joints, Twin Disc is now building U-joints for the American market which incorporate all the outstanding features of GWB's time-tested design. These include caged needle bearings with relieved end needles, double-lip seals, nylon thrust bearings and tapered-shoulder trunnions.

Twin Disc-GWB joints are offered in four sizes, two of which — the J-230 and J-310 — are currently in production. The other two — the J-170 and J-490 — are scheduled for production early in 1962. Each size includes six different types of varying lengths in slip and non-slip designs.

The life expectancy of a U-joint is essentially an expression of the life expectancy of its roller bearings. Obviously, the larger the bearings, the longer the useful life of the joint, and — size for size — Twin Disc-GWB Joints feature larger bearings than competitive units.

This is made possible by the high-wing bearing design of all Twin Disc-GWB assemblies. High-wing bearings permit use of a maximum diameter bore in the bearing cap to accommodate a larger bearing *without increasing swing diameter.* This is an important consideration to designers who are now experiencing unsatisfactory U-joint performance yet do not have space for a larger size.

RATED CAPACITY

Size	Max. Oper. Torque (lbs.-ft.)	Dynamic Factor	Static Factor
J-170	4,250	16.6	5.05
J-230	6,100	22.98	7.32
J-310	8,400	31.40	10.00
J-490	12,700	49.00	15.15

For complete engineering details on Twin Disc-GWB "J" Series Universal Joints, request Bulletin 513. Twin Disc engineers will be glad to make recommendations for "J" Series assemblies as replacement units as well as for new applications. Contact the Application Engineering Dept., TWIN DISC CLUTCH COMPANY, Hydraulic Division, Rockford, Illinois.

Heads F-M Diesel Sales

J. W. Chandler

Fairbanks, Morse & Co. has advanced John W. Chandler from assistant to manager of diesel sales. He succeeds Sheldon K. Howard, who recently became the Beloit Group director of marketing. Chandler joined Fairbanks, Morse in 1946 at St. Paul, where he became office manager two years ago. He is a graduate in mechanical engineering from the University of Minnesota and has also studied diesel engineering at Pennsylvania State University and advanced administration in St. Thomas College.

Cuno Marketing Head

James E. Duff, formerly general sales manager of Joy Manufacturing Company's Electrical Products division, St. Louis, Mo., has been elected vice president in charge of Marketing of the Cuno Engineering Corp., a subsidiary of American Machine & Foundry Co. Mr. Duff was previously associated with Cuno from 1954 to 1957 as Eastern District sales manager and from 1951 to 1954 as advertising and sales promotion manager. Prior to 1951 he was with Frank W. Hankins & Associates, industrial marketing consultants, in Philadelphia.

Boeing Designates New Positions

Mr. W. B. Anderson has been named assistant chief engineer of the Boeing Industrial Products Division by D. J. Euler, division vice president-general manager. It was also announced that Chief Engineer S. D. Hage has been reassigned as technical assistant to the division's vice president.

A 15-year Boeing veteran, Anderson has been project manager of the Boeing 520 turbine program. In his new position he will have direct supervision of engineering activities concerned with development and production of Boeing gas turbine engines. Mr. Hage will act as technical consultant to Euler and the division and will concentrate on new product plans. Both Hage and Anderson have been associated with the Boeing turbine program since its inception in the mid-1940s.

General Motors Consolidates Cleveland Division With EMD; Names T. E. Hughes to New Position

IT has been announced that the operations of the Cleveland Diesel Engine Division of General Motors will be consolidated with the Company's Electro-Motive Division. Transfer to EMD headquarters at La Grange, Ill. of the Cleveland Diesel operations is expected to take approximately a year to complete. Effective immediately however, is the appointment of Thomas E. Huges, former general manager of Cleveland Diesel, to the new post of director of marine and government activities for the Electro-Motive Division.

Mr. Hughes, a graduate of the University of Illinois in 1932 where he majored in ceramic engineering, joined General Motors as a test engineer with Cleveland Diesel in 1933. He was transferred to Cleveland's engineering department in 1936 and in 1937 and 1938 he was engaged in service engineering work in development of the diesel engine for the railroad business working with Electro-Motive and the central engineering group in Detroit.

Mr. Hughes later transferred to the west coast as Cleveland's service and engineering representative at the U.S. Navy submarine base in San Diego and the Mare Island Navy Yard in California. During World War II, he managed Cleveland Diesel's Washington, D.C. office, and then, in 1946, was named general sales manager for the division with headquarters at Cleveland. He became assistant general manager in October, 1951, and on Jan. 1, 1953, was promoted to general manager of the division.

Thomas E. Hughes

Cleveland Diesel has been producing diesel engines for commercial, marine and industrial uses, and gas and dual-fuel engines for industrial uses. The consolidation will permit intensified research and development activities in marine and related markets and improve servicing of the equipment in these fields.

Unsynchronized Transmission

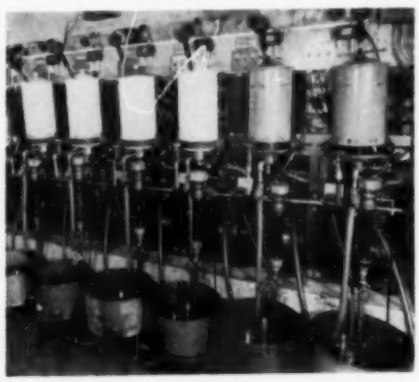
Model 8125-U, an unsynchronized version of Spicer's 12-speed transmission, is now available to operators of heavy-duty vehicles. Introduction of the 8125-U gives truckers a choice of synchronized or unsynchronized units in a multi-speed transmission. With the exception of the hand shift synchronizers, which are eliminated, model 8125-U retains all the design and operating features of the fully-synchronized 12-speed box. Synchronizers for the splitter and range shifts, which are air operated, are still retained. To provide space for a clutch brake, the depth of the clutch housing is increased ⅝ in., which adds to the overall length of the unit by the same amount. This clutch brake facilitates shifting into first and reverse without severe gear clash. Because it provides sufficient low gear reduction (10.45 to 1), plus progressive, non-overlapping, close steps to handle varying road and load conditions, the use of supplemental gearing with the 8125-U is not required. The average rpm spread between all gears, 1 through 12, is 455 rpm. The unsynchronized unit is available as factory-installed original equipment, or operators who so desire may readily convert present synchronized 12-speed units in the field. A conversion kit, Spicer Kit No. 311329-X, is available through local truck dealers and distributors from whom fleet equipment is purchased. For more information write Dana Corp., Toledo, O. (ITS NEW)

New Heavy-Duty Lube, Fuel Filter

Wix CW-750-MS Cartridge

A new series of filter cartridges developed primarily for depth filteration of diesel lubricating oils but well suited to fuel oils also is now being produced by Wix Corp. at its Gastonia, N. C., plant. Manufactured initially in two sizes, the filters are designated series CW-550-MS and CW-750-MS. The former is generally designed for diesels with crankcase capacities up to 5 gals., and the larger model for engines up to 8 gals. capacity. Size and application, of course, varies according to service.

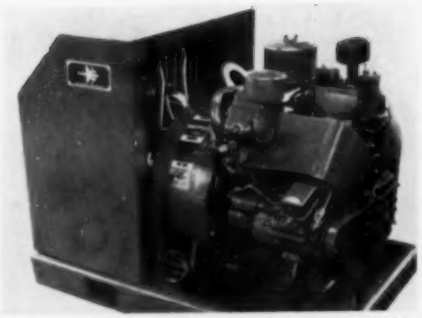
The new filters have been more than four years in development with extensive laboratory and field testing. In final design, the cartridges use a new depth type filter media termed Micro-mix developed to attain high efficiency especially considering detergent type oils while maintaining desirable flow characteristics. Using SAE #30 oil at 180° F. a #6 ($\frac{3}{32}$" dia.) orifice in the filter housing and an inlet pressure of 40 P.S.I., 2916 grams (6.4 lbs.) of finely divided solid particulate matter can be removed by the CW-750-MS cartridge while maintaining a flow rate better than .5 gpm., according to Wix engineers. In the manufacturing process, the materials which make up the filter media are automatically metered in precise proportions into a machine in which they are uniformly blended. The media is then accurately weighed into the packing machine and packed in such a manner that a uniform density is insured. This type of processing, Wix engineers stated, assures uniform filtration and flow characteristics over the entire cartridge.



Lube filter element test stand in Wix laboratories.

Mobile Set For Electronics

A new prime power source especially for mobile electronic applications has been introduced by Consolidated Diesel Electric Corp. Powered by a lightweight, American Marc air-cooled diesel engine, the package delivers all voltages normally associated with electronic equipment—28.5-volt DC; 120-volt, 400-cycle AC, and 120/208-volt, 60-cycle AC—from a single generator designed by The Lima Electric Motor Co., Inc. The power package consists of the engine, the generator, and a panel containing all controls. The engine-generator combination is shock-mounted on an aluminum base. The complete unit weighs 1,100 lbs. and measures 49 in. in length, 31 in. in width and 36 in. in height. It can deliver 4 kw of dc, 6 kw of 400-cycle ac, 6 kw of 60-cycle ac or any combination of the voltages not exceeding a total of 7½ kw. The 400-cycle alternating current output is three-phase, three-wire. The 60-cycle output is three-phase, four-wire. Both are rated at 80% power factor. The American Marc engine is a two-cylinder, four-stroke cycle, air-cooled, V-type diesel engine providing 13 brake-horsepower at its hydraulically governed speed of 2000 rpm.



Complete details on model 2012-AS are available from Power Equipment Division, Consolidated Diesel Electric Corp., Stamford Conn. (ITS NEW)

Gulf Coast Power Notes

By Elton Sterrett

EMPRESA Gualtemalteca De Aviacion, Gualtemala, Central America, has bought from Stewart & Stevenson Services, Inc., of Houston, a model SPGD-90, 90 KVA, 400 cycle self-propelled ground power unit, powered with a General Motors series 71, 4-cylinder diesel.

O. L. Olsen Co., Houston, has bought from Waukesha Sales & Service, Inc., Houston, two model VLROBU diesels, for delivery to the Goliad Corp., Sheridan, Tex.

BROWN & Root, Inc., Houston, has taken delivery of a series 71, 4-cylinder General Motors diesel, torque-converter equipped, from Stewart & Stevenson Services, Inc.

THE Commandant, Marine Corps, Washington, D. C., has ordered 15, 45 kw, 400 cycle, ac generating sets from Stewart & Stevenson Services, Inc. Each unit is powered by a General Motors series 71 3-cylinder diesel. The units are for the Hawk missile program.

E. E. Farrow Co., Dallas, has purchased a model 45GD-53 Stewart & Stevenson 50 kw, ac generating set, powered by a series 53, 4-cylinder General Motors diesel.

BILBO-Redding Drilling Co., Houston, has bought from Zagst, Inc., Houston, a model D-320 40 kw, Caterpillar electric generating set.

PORT Houston Iron Works, Inc., Houston, has taken delivery on a model 2GD-23 Stewart & Stevenson 20 kw, ac generating set, powered by a series 71, 2-cylinder GM diesel.

LAKESIDE Irrigation Co., Eagle Lake, Tex., has installed a model 10000 Allis-Chalmers generator set, rated at 60 kw continuous output. The unit was furnished by Applied Power Equipment & Manufacturing Company, of Houston.

BRAZORIA County, Precinct Three Road Department, Alvin, Tex., has bought from Stewart & Stevenson Services, Inc., Houston, a Petter AC/3000 generating set, powered by a one-cylinder Petter diesel.

DRILLING & Exploration Co., Dallas, has bought from Waukesha Sales & Service, Inc., Houston three model VLROBU Waukesha diesels, to repower an oilwell drilling rig in its New Mexico operations.

HARDY Egg Farms, League City, Tex., has purchased from Stewart & Stevenson Services, Inc., Houston, a model AC/6500 Petter generating set, powered by a 2-cylinder Petter diesel.

EMPIRE Electric Co., Fort Worth, Tex., has obtained from Zagst, Inc., Houston, a model D-397 Caterpillar 300 kw generating set, destined for installation at Ellsworth Air Force Base, Rapid City, S. D.

TOMMY Tompkins, Alamo, Tex., has obtained from Stewart & Stevenson Services, Inc., Houston, a series 53, 4-cylinder General Motors diesel.

SOUTHWESTERN Bell Telephone Co., Houston, is installing a Stewart & Stevenson model 4GD-75S emergency generating set in a new dial building, San Antonio. The 75 kw unit is powered by a series 71, 4-cylinder General Motors diesel.

AMERICAN Towing Co., Morgan City, La., has secured from Waukesha Sales & Service, Inc., Houston, two model WAKDSM marine diesels, each

equipped with Twin Disc model DMG-512 reduction and reversing gears.

DELTA Airlines, Inc., Atlanta, Ga., has taken delivery on three model TTGD-490-DAL 90 KVA, 400 cycle trailer mounted Stewart & Stevenson ground power units.

CENTRAL Texas Bus Lines, Waco, Tex., is repowering four of its buses with series 53, 4-cylinder General Motors diesels, obtained from Stewart & Stevenson Services, Inc.

ST. MARY's Hospital, Gates Memorial, Port Arthur, Tex., is installing an emergency power plant incorporating an Allis-Chalmers model 10000 diesel and and an E-M 75 kw generator. The set was supplied by Applied Power Equipment & Manufacturing Company.

TRANS-CANADA Airlines, Ltd., Montreal, Quebec, Canada, has bought three Stewart & Stevenson model SPGD-475 self-propelled ground power units, rated 75 kw and driven by GM series 71 4-cylinder diesels.

Plant Manager

Appointment of Joseph Kontra as plant manager of the Van Nuys, Calif. plant of Purolator Products, Inc., has been announced. Mr. Kontra was formerly assistant plant manager at the new plant which was established by Purolator in 1960 to specialize in the manufacture of filters for the aircraft and missile industries. He replaces Judd Nesbitt who has retired. Mr. Kontra joined Purolator in 1955 and in 1960, was given responsibilities for the establishment of purchasing in production control functions at the Van Nuys plant.

Witzky Joins SwRI

Julius E. Witzky has joined the staff of the department of Automotive Research at Southwest Research Institute as a senior research engineer. Mr. Witzky received his diploma in engineering from the Polytechnikum, Stuttgart, Germany. He is known internationally as the designer of diesel engines in a power range from 40 to 2,000 horsepower. Mr. Witzky came to the United States from Germany in 1945 under a special program that provided for entry of prominent foreign scientists. In this country he joined the Packard Motor Car Co. where he designed and developed light weight diesel engines for the U.S. Navy. He then accepted the position of chief engineer of Daimler-Benz North America. Two years later he was named director of research for White Motors, a position he held until joining Southwest. At SwRI, Mr. Witzky will work in a broad field of research covering many phases of diesel engine study.

Named Executive V. P.

Marman-Herrington has appointed Richard O. Thomas executive vice-president. He will be in charge of all Indianapolis operations which include the manufacture of school bus bodies, heavy duty over-the-road tractors, city transit and suburban coaches and rear-engine transit chassis. The company is also engaged in supplying complete power trains for Greyhound dual-level scenicruisers under terms of a $10 million contract recently awarded them. Mr. Thomas joined Marmon-Herrington in February, 1960 as vice president and general manager of the new Oneida Division when the school bus body business was purchased and moved to Indianapolis from Canastota, N. Y.

First Engine Builder Joins ADS At Minneapolis Meeting

Shown at the registration desk of the recent A.D.S. convention in Minneapolis, are, standing left to right: Martin Fromm, Executive Director of the Association; O. K. Wright from the Association Office; Guil Halket, Texas Fuel Injection Service, Dallas, Texas, Chairman, A.D.S. Exhibits Committee; S. E. Franklin, Diesel Control Corp., Wilmington, Calif., President; and V. J. D'Aversa, A & D Diesel Service, Brooklyn, N. Y., Treasurer. Seated are a registration assistant and Manuel A. Gerhardt, Gerhardt's, Inc., New Orleans, La., a director.

THE Association of Diesel Specialists, one of the more rapidly growing technical groups in North America, recently completed its fifth annual meeting and exhibit, which was held in Minneapolis at the Leamington Hotel. The program, as reported in our September issue, was well balanced with excellent interest, especially with regard to the service seminars conducted by the major fuel injection equipment manufacturers. The three-day program, coupled with the largest exhibit to date, prompted ADS President Stan Franklin to term the meeting, "especially successful and indicative of the way ADS is developing to meet the industry's needs." Pointing in this direction was the announced membership of the Enterprise Power Division of General Metals Corp., the first engine builder to join the organization.

In his opening remarks, President Franklin referred to the growth of the ADS in saying, "The dedication of a trade association toward the dignity and value of the group to an ultimate engine user can upgrade the caliber of service and better the operation of equipment to which the Association efforts are directed. This means a large and increasing membership which ultimately should include all of the manufacturuing and service groups involved in the maintenance and operation of the prime mover concerned. Four years ago when this Association was founded, only very limited usage was forecast in the realm of cooperative service information. Steadily each year, thinking has expanded the scope of the Association's activities due to the increasing needs in the service field. Members are now contemplating service problems centered around, not simply fuel injection equipment of a diesel engine, but many of the other accessories requiring specialized items used on diesel and other prime movers, including the gas turbine."

Twenty-one manufacturers of diesel equipment and accessories displayed and demonstrated their equipment at the meeting. These included: Diesel Injection Sales and Service; Frank Murphy; Unitest; Scintilla Division, Bendix Corp.; Turner; Hartford Machine Screw Co.; C.A.V. Fuel Injection Equipment; Kiene Diesel Accessories, American Bosch; U. S. Aviex; Robert Bosch; Magnus Chemical; Spray Products Corp.; Fram Corp.; Pressure Products Co.; and Federal Machine Tool Co. Other features of the Minneapolis meeting included a tour through the Minneapolis-Moline plant and a trip to the diesel fuel injection shop of Diesel Service Company, Minneapolis ADS member. The next semi-annual meeting will be held in New Orleans, Feb. 15-18, 1962.

CFC Announces New Appointments

M. F. Schaible

C. F. Holland

Five new appointments have been announced by Commercial Filters Corp. following completion of a merger with RAD, Inc., a Cincinnati research and development firm. RAD will function in Cincinnati as a division of Commercial Filters, which operates from newly expanded administrative headquarters and plant in Melrose, Mass., and plants in Lebanon, Ind. Simultaneously with the merger, Michael F. Schaible succeeded Robert L. Fielding as President and Chief Executive Officer. Mr. Fielding will serve as Vice-Chairman of the board.

The following new appointments have just been announced: Alfred F. Duemler, Jr. has been named Vice President and Treasurer of CFC. He was associated with RAD, Inc. as Vice President following three years as Plant Manager of the Louisville Brass Plant of American Radiator and Standard Sanitary Corp.; Carl F. Holland is appointed General Sales Manager. He was previously Sales Manager of the Honan-Crane and Delpark product lines; E. John Van Lier is named Chief Product Engineer. He was formerly Engineering Supervisor of Technical Sales for Purolator Products, Inc., Development Engineer with Komline & Sanderson Engineering, and Project Engineer with American Cyanamid Co.; Fred C. Valentin is named Chief Manufacturing Engineer. He was Manager of Manufacturing Engineering at Purolator Products, Inc. and was previously with Worcester Pressed Steel and Greer Hydraulics; Charles T. Rose is appointed Chief Industrial Engineer.

Diesel Tachometer Generator

A tachometer generator to permit use of Radson transistor tachometers with diesel engines and other mechanical rotation applications, has been introduced. A new magnetic design eliminates contacts. Because no cams or points are used, the generator can be safely operated in an explosive ambient. Magnetically-induced output provides 2v minimum at 500 rpm. Fitting is standard sae $\frac{7}{8}$ in. with choice of shaft size. Lightweight extruded aluminum case measures only $1\frac{1}{8}$ in. (hex) by $2\frac{5}{32}$ in. The tachometer generator is simply attached to the engine fitting and two leads are connected directly to the transistor tachometer. For more information write Radson Engineering Corp., Macon Ill. ITS NEW

Perfex Expands Facilities

Perfex Corp., Milwaukee manufacturer of heat transfer products, celebrated its 50th Anniversary by expanding facilities. A portion of the Boheim Property (formerly The Lindemann-Hoverson Plant) has been purchased by Perfex from Western Industries, Inc. for an undisclosed sum. Mr. I. G. Bohrman, president of Perfex, stated: "This new acquisition of facilities will give us a total of 363,000 sq. ft. of plant facilities, increasing our capacity by 53 per cent. We are intent upon future expansion of present, as well as new, heat transfer products; including additional research and development facilities for future product progress and diversification."

Florida Diesel News

By Ed Dennis

DIESEL Shipbuilding Co., Atlantic Beach has laid the keel for a 70 ft. triple screw fireboat for the City of New York to be powered by three GM V12 diesel engines totaling 1300 hp with 3:1 rdr gears and Columbian three bladed propellers. It will cruise at 20 mph and pump 5000 gpm.

UP at Clewiston the U. S. Sugar Corp. took delivery of 18 Caterpillar D6 series B crawler tractors with 93 hp Cat diesel engines.

THE Equipment Service Co., Inc. of Mobile Ala., has been appointed dealer for Deutz diesel engines for Northwest Florida and Alabama.

THREE Allis Chalmers model 11000 diesel engines rated 150 cont. hp at 1800 rpm and with Twin Disc power take off, have been installed on the new Talisman Sugar Co. plantation to provide power for 36 in. turbine pumps in drainage canals. They came from Richardson Tractor, Fort Lauderdale.

THE new three yd. Lorain motor loader doing clean up work on the Biscayne Canal and owned by the Rayall Co. is powered by a model JNS-6-BI Cummins diesel rated 123 cont. hp at 2200 rpm and 175 max at 2500 rpm.

EAST of Belle Glade, the Double D Ranch had four GM 6V (7064-7200) diesel engines installed to provide power for four B-C 40 in. lo-lift irrigation pumps at one of their pumping stations on the ranch.

THE 203 ft. *Maria Veronica*, an ex-navy LSM, was converted by Dade Drydock, of Miami, to a Chilian coastal freighter for Sr. J. Manual Cordova of Santiago Chile. It is powered by a pair of 10 cylinder Fairbanks Morse (OP) diesels each rated 1600 hp at 72 rpm.

TWO model 56 Lorain draglines powered with GM 4-71 diesels and GM torque converters and three No. 26 Lorain units with 3-71's were delivered to the Talisman Sugar Plantation for canal construction work by the L & A Construction Co. from Richardson Tractor Co.

COASTAL Motors of Belle Glade delivered three DFW 7010 General Motors dieselized hiway tractors to the Sawyer Ranch to pull sod carriers.

MARINE Industrial & Equipment of Jacksonville supplied the two 230 kw Onan generating sets powered by model WAKDBSU Waukesha diesel engines each rated 311 hp at 1200 rpm, for standby at the Intercounty Telephone Building in Fort Myers.

ZINK-Smith Construction Co. working at the Homestead Air Force Base took delivery of a model 380 Michigan tractor dozer powered by a GM 7123-7200 (12V-71) diesel engine. The net rated shp is 322 at 1835 rpm.

A Lister Blackstone model HB-3 with a hp rating of 51 and 2000 rpm and a Twin Disc clutch to provide power for a saw on a tree header unit for John H. Kindel of South Dade from Shelley Tractor & Equipment Co.

A General Motors 6-71, 142 hp at 1800 rpm, provides power for a Gardner Denver model 600 rotary air compressor used in conjunction with an Ingersoll-Rand dynamite drill rig for L. & A. Construction Co. of Okeechobee.

SHIPPED into and reassembled for work on Indian Prairie Canal, a Bucyrus-Erie model B210 dragline powered with a Superior model 40-SX-8 turbocharged diesel engine and a 500 kw generator. This new eight-yard job is all electrically controled through eddy-current clutches.

THE East Volusia County Mosquito Control Commission had a model 4-53 General Motors marine diesel engine with Borg Warner 2.1:1 r & r gears installed in their *Mr. Sam*, work boat. The new installation has a rating of 85 cont. hp at 2200 rpm. From the Jacksonville Br. of Detroit Diesel Division.

UP near Mayo the Dell Mine is using a HD-16 Allis Chalmers dozer tractor powered by a HD-844 A-C diesel rated 163 hp at 1600 rpm plus a HD-11 Allis Chalmers tractor with a six cyl 99 hp A-C diesel in their mining operation.

ELLIS Diesel Sales & Service of Fort Lauderdale repowered the 40 foot sportsfisherman *Uzelle* with a pair of 4-71 inclined GM diesel engines having a displacement of 283.7 cu. in. and rated 151 hp at 2300 rpm with 2:1 GM r & r gears and 24 X 26 propellers.

TWO 1000 hp model T1000S Solar gas turbine engines power a new prototype Coast Guard patrol vessel now undergoing sea trials off Miami. This search and rescue craft can do 26 knots.

National Marine Promotions

Eugene E. Ahlemeyer has been named to the new post of general manager engineering services and William A. Creelman to the position of general manager, of vessel operations, it was announced by David A. Wright, president, National Marine Service Inc. Mr. Ahlemeyer, has been with the company since 1953, and for the past three years, had been managing the diesel engine maintenance, and barge cleaning and repair operations of the company based at Hartford, Ill. Mr. Creelman was previously manager, Eastern area operations and Gulf area operations.

$900,000 Parts Order

Fairbanks, Morse has received a U. S. Navy contract for more than $900,000 for diesel engine spare parts, A. Leo West, vice president and Beloit (Wis.) Group executive, announced. The parts, purchased by the Ships Parts Control Center at Mechanicsburg, Pa., will be used in servicing vessels which use Fairbanks-Morse propulsion equipment.

Michigan-Ohio News

By Jim Brown

COREY HARTWIG of Hadley, Mich. bought a Hough D-120 with an IH model DT817 diesel engine. The new Hough will be used on road construction work and was purchased from Wolverine Tractor & Equipment Co. of Detroit & Grand Rapids.

CUMMINS Diesel Michigan Inc. of Dearborn recently installed a model NH-220-B Cummins engine in a model C85T Autocar. The installation was done for Gerald Wiggins of Dearborn, Mich.

A diesel model D-12 Del Mag Hammer was recently purchased by Ken Marks Co. of Port Huron. It will be used for driving piles and bridge building projects and was purchased from Cyril J. Burke, Inc., of Detroit.

K. G. Marks of Port Huron, Mich. has accepted delivery on a model W-9 Case 4-wheel drive loader, powered by a Case 301D diesel engine. Distributor of Case equipment was J. R. Panelli Equipment Co. of Southfield, Michigan.

THE R. G. Moeller Co. of Detroit recently sold a John Deere model 1010 diesel crawler tractor powered by a John Deere 4-cylinder diesel (40 hp) to D. J. McQuestion of Traverse City, Michigan.

CUMMINS Diesel Michigan Inc. recently installed a Cummins C-180-CI diesel in a Hough H-90 Payloader for Saginaw Asphalt Paving Co., Carrollton, Mich.

THE Boan Co. of Livonia, Mich. has accepted delivery on a Northwest model 6 pullshovel (1¾ yd.) equipped with a high-speed boom hoist and powered by a Murphy model 20 diesel engine. Sale was made by Cyril J. Burke Inc.

OTTO Taylor Construction Co. of Saginaw, Mich. has accepted delivery on a model H-70 Hough Payloader powered by a Cummins diesel engine. Sale was made by Wolverine Tractor & Equipment Co.

J. R. Panelli Equipment Co. has delivered a Case model 1000 with tilt crown dozer and Continental JD382 diesel to the Du Pine Co. in Ann Arbor, Michigan.

A John Deere model 440 industrial diesel tractor powered by a GM 2-53 engine was recently delivered to Arthur Obermiller of Taylor, Mich. Sale was made by the R. G. Moeller Co.

A 320 hp Cummins diesel model NHRS-6-I was recently installed in a Manitowac crane for McNally & Nimergood of Bay City. Installation was done by Cummins Diesel Michigan Inc.

HERBERT C. Newman of Brighton, Mich. has accepted delivery on a Case model 800 crawler with tilt crown dozer and powered by a Continental HD 277 diesel engine. Sale by J. R. Panelli Equipment Co.

TROY Aggregate Haulers Inc. of Troy, Mich. has accepted delivery on a new Hough H-12 Payloader powered by an IH UD-370 diesel engine. The new Hough H-12 is on crawlers and was purchased from Wolverine Tractor & Equipment Co.

CUMMINS Diesel Michigan Inc. has installed a NH-220-B Cummins diesel in a FWD truck for Konig Coal & Supply Co. of Detroit, Michigan.

TELEGRAPH Supply Co. of Detroit has accepted delivery on two Hough H-70 Payloaders with Cummins engines. Wolverine Tractor & Equipment Co. is the local Hough distributor.

Firms Merge

Pressure Products Co., West Chester, Pa., and Canton Chemical Corp., Wilmington, Del., have merged under the name of Pressure Products Co., Division of nuAero Corp., Arthur Haines, president of the new corporation announced. The two companies formerly located in the same general markets—but on a non-competitive basis. Canton Chemical Co. concentrated in the manufacturing and selling of cleaning and polishing products to the automotive trade. Pressure Products was primarily concerned with producing and selling pressure packed products to the automotive field. Their major efforts revolved around nuAero Starting Ether—a priming fuel for all types of engines—and included products in aerosols sold extensively to the contractors, heavy equipment and farm machinery fields for many years.

Cooler Catalog

Release of a catalog covering evaporative coolers, is announced by the Young Radiator Co. The comprehensive 4-page catalog gives detailed information on the Young evaporative coolers for cooling jacket water, lube oil, compressed air and natural gas or for condensing steam and hydrocarbons. The various sections of the catalog cover in detail design features, piping diagrams of sample units and dimensional drawings and tables. Write for Catalog 1961-4P to the company's Advertising Dept., Racine, Wisconsin. (ITS NEW)

Elliott District Manager

H. P. Hostetter, Western Regional manager of Elliott Company, Jeannette, Pa., announced appointment of John L. Sullwold as manager of Elliott's Los Angeles district. This district covers Southern California, the southern tip of Nevada, and the entire state of Arizona. Mr. Sullwold was a compressor specialist in Elliott's Western region, a position he held until his recent promotion.

Acquire Coupling Firm

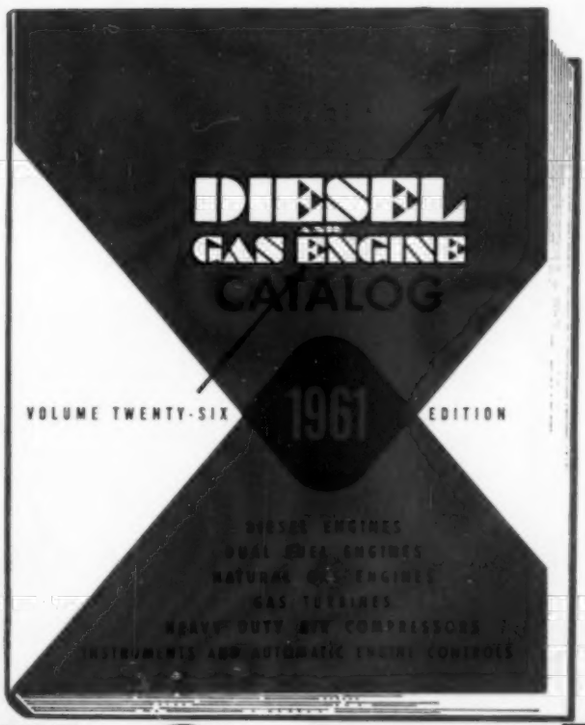
Purolator Products, Inc., Rahway, N. J., announced acquisition of On Mark Couplings, Inc., Los Angeles, Calif. On Mark is a major designer and manufacturer of a line of flexible and "quick disconnect" couplings required in the fueling of aircraft and missiles. In addition, the company has designed couplings which perform a vital function in connecting several segments of multi-stage rockets.

C-B Locomotive Manager

E. J. Fithian, Jr. has been named manager, Locomotive Engines for The Cooper-Bessemer Corp. of Mount Vernon, Ohio. He will be responsible for coordination of the efforts on Cooper-Bessemer's locomotive engines among the sales, engineering, accounting and manufacturing departments. These engines are manufactured in the company's Grove City, Pa. plant. Mr. Fithian was previously supervisor of Railway Engineering.

AVAILABLE NOW

New complete information on engines and accessories!



If you design, purchase, sell, operate or service diesel, dual fuel, natural gas engines or gas turbines — **Here is important information for you!**

LOOK AT THE CONTENTS!

1. ENGINES—All major manufacturers of diesel, dual fuel, natural gas engines and gas turbines are represented in multiple page sections. Text is supplemented with specifications, power curves, photographs and sectional views.

2. TURBOCHARGERS and SUPERCHARGERS—This section of manufacturers is detailed and fully illustrated to give complete information on this increasingly important phase of the industry.

3. TRANSMISSIONS—The latest information on torque converters, fluid drives, and other modern means of transmitting power are fully described and illustrated in this section.

4. ACCESSORY EQUIPMENT—Recent developments in fuel injection systems, governors, and other key accessory units are detailed and illustrated fully in this section.

5. AIR/GAS HEAVY DUTY COMPRESSORS—This section deals with heavy duty compressors of all types applicable to all industry and petroleum services.

6. INSTRUMENTS and AUTOMATIC ENGINE CONTROL—This section covers just what the title states.

7. GAS TURBINES—This section is devoted to the gas turbines currently on the market, both in this country and abroad.

8. ADVERTISING—Leading manufacturers of engines, accessories, and services bring out the important features of their products in attractive, easy to read advertisements to further enhance the reference value of the CATALOG.

1961 DIESEL & GAS ENGINE CATALOG

Order Yours Now!

Still only $10. per copy!

Postpaid

DIESEL AND GAS ENGINE CATALOG — **ORDER BLANK**

10850 Riverside Dr., North Hollywood, Calif.

Enter our order for _____ copy(s) of Volume 26, DIESEL AND GAS ENGINE CATALOG.

Check is enclosed ☐ Bill us ☐

$10.00 per copy plus state sales tax when delivered in California. When ordering from Sterling Areas, remit £4.0.0 to DIESEL PROGRESS, St. Paul's Corner, Ludgate Hill, London, E.C.4.

NAME _____ POSITION _____

COMPANY _____

BUSINESS CLASSIFICATION _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

ADVERTISERS' INDEX

Power plant stretches diesel service -cuts maintenance costs- with AMERICAN D&G Oil No. 53

By C. F. KLENNER **Carl Klenner is a specialist at helping customers with their lubrication problems. A graduate of the Michigan College of Mining and Technology, he has been serving commercial customers since 1948. He also attended the Company's Sales Engineering School.**

* * *

At Roseau, Minnesota, the Municipal Power Plant uses Fairbanks Morse Diesel Engines for the generation of the city's electricity. And since 1946, lubricating oils supplied by our Company have played an important part in the excellent maintenance of this plant.

For example, diesel unit number two was overhauled in 1954 after six years' service. At our recommendation, AMERICAN D&G Oil No. 53 was put in the crankcase at that time. After 19,000 hours of oil service, the unit was taken down again. All rings were free, bearings and rings showed minimum wear, and there was negligible carbon on the piston skirts. With AMERICAN D&G Oil, this unit has averaged 4,584 horsepower-hours per gallon of oil.

For additional information about AMERICAN D&G Oil, contact your nearby American Oil Office.

Quick facts about
AMERICAN D&G Oil

- Made from highest quality solvent-refined stock.
- Contains additives which impart superior detergent-dispersant and anti-corrosion properties.
- Anti-foaming.
- Oxidation resistant.
- Recommended for
  —use with economy fuels.
  —extreme load service.
  —low temperature service.

AMERICAN OIL COMPANY
910 S. Michigan Ave., Chicago 80, Ill.

AMERICAN

American's C. F. Klenner checks performance reports with power plant superintendent Carl Grand.

Announcing new diesel engine with less weight per horsepower

For a truly heavy-duty engine, the new KSV provides unusually high horsepower-to-weight ratio, introducing unusual economies in all kinds of stationary and marine services. Shown above on test, this new Cooper-Bessemer 4-cycle engine has proved extremely rugged in continuous operation. It has completed two years of development testing and is now available in 12 and 16 cylinder designs, in spark-ignited gas, diesel, dual-fuel and tri-fuel types . . . for 2960-4280 bhp, 450-514 rpm service.

The high horsepower-to-weight advantage of the KSV results from unique design features including large bore-stroke ratio and short pistons, with relatively high rpm.

Call the nearest office for further information or write The Cooper-Bessemer Corporation, Mt. Vernon, Ohio.

Cooper Bessemer

GENERAL OFFICES: MOUNT VERNON, OHIO

COMPRESSORS: RECIPROCATING AND CENTRIFUGAL
ENGINES: GAS · DIESEL · DUAL FUEL
JET-POWERED GAS TURBINES

VOL

2

12